

LECTURES ON SURGERY

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PREFACE TO THE SECOND VOLUME

THE last line of this Volume had been corrected, the last proof returned from the hands of the printer, when death removed its Author from our midst ; so the end of the work and of the worker have come together. This present edition is therefore in every way the perfect and ripe fruit of his experience. As such it is now offered to the public.

June 15, 1882

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EXPLANATION OF PLATES.

EXCISION OF JOINTS.—PLATE XVI.—Page 616.

- Fig. 1. Sketch from a photograph of a patient, showing the result of excision of the knee-joint.
- Fig. 2. Sketch from a photograph of a patient after excision of the shoulder-joint by single incision. Showing the appearance of the shoulder, and the power which the arm retains.

PLATE XVII.—Page 636.

- Fig. 1. Excision of the head of the humerus, by the method recommended in the Lecture, pp. 634 to 636. The saw is shown in the Plate as applied from behind, as it should be in operating on the left arm. In operating on the right arm the surgeon grasps the projected head of the bone with his left hand, and saws the bone from before backwards.
- Fig. 2. Outline figure, showing the lines of incision used for excision of the elbow-joint. Page 636. The dotted lines represent the positions of the single longitudinal, and II incisions.
- Fig. 3. Excision of the elbow by the single longitudinal incision. The position of the narrow saw is shown as applied for removal of articular ends of the ulna and radius.
- Fig. 4. Excision of wrist-joint, by the two lateral incisions, (reduced from a plate in Bourgety and Jacob's *Operative Surgery*). The only difference between this and the modern operation is, that in the latter the bone-pliers and narrow saw are used instead of the chain-saw represented in the plate. See page 641.
- Fig. 5. Excision of the knee-joint by lunated incision. The condyles of the femur have been removed, and the narrow saw is shown as applied for removing a thin slice from the articular surface of the tibia. Pages 644, 645.
- Figs. 6, 7, 8, and 9. Dr. Watson's apparatus for the purposes of after-treatment in cases of excision of the knee-joint. Page 646.

AMPUTATION—DISSECTIONS OF STUMPS.—

PLATE XVIII.—Page 652.

- Fig. 1. Dissection of a double-flap stump of the forearm, showing the muscularity retained, and the neuromata resulting from section of the

great nerves. It will be observed that the ends of the median and ulnar nerves, although far from the cicatrix, and deeply covered, present neuromatous enlargement, yet the stump was not a painful one.

- Fig. 2. Dissection of an old stump of the thigh, formed by circular amputation. The femur projects the cicatrix, there are numerous neuromata, one nerve is stretched over the end of the bone.
- Fig. 3. Stump of arm which had been amputated in early life by Mr. Liston. The bone continued to grow and projected the cicatrix; this projection terminated in a hook-like process. The case is referred to at page 652.
- Fig. 4. Stump of leg, formed by long posterior flap method, thirteen years before the patient's death. The fibres of the gastrocnemius and soleus muscles, folded over the end of the bone, present all their muscular character, and very considerable thickness. See page 652.
- Fig. 5. Drawn from a sketch, taken by the late Sir Charles Bell, from an operation in the Royal Infirmary, to show the redundancy of muscle in the flap method by transfixion. The case was one of primary amputation.

AMPUTATION.—PLATE XIX. — Page 658.

- Figs. 1, 2, 3, 4, and 5, represent the method of amputation of the thigh by a long anterior flap, on the principles recommended by the Author. Pages 657, 658.
- Fig. 1. The dotted lines mark the incisions and extent of the long anterior and short posterior flap.
- Fig. 2 shows the cut surface of the flaps, and the section of the condyloid end of the femur, after the operation is completed.
- Figs. 3 and 4 are reduced copies of sketches from nature of a stump formed by the above procedure, twenty-one days after the operation. Fig. 3 gives a lateral, and Fig. 4 a front view of the stump. Sketched by Dr. Caton.
- Fig. 5 represents the result of the operation, about a year after amputation. The anterior flap is firmly consolidated over the end of the bone, and the cicatrix is seen to be retracted on the posterior aspect of the limb. By Mr. Livesey.
- Fig. 6 is an outline sketch from a stump, formed by double flap, after Liston's method, of equal anterior and posterior flaps. The line of the cicatrix is seen in the centre of the surface of the stump, corresponding to the end of the bone.
- Fig. 7. Outline sketch of the Author's modification of Liston's method, described at page 653.

PLATE XX.—Page 694.

- Fig. 1. Amputation of a finger, by the method described at page 694.
- Fig. 2. Amputation of forefinger. The distal end of the metacarpal bone is being removed obliquely by the angular cutting-pliers.

Fig. 3. Removal of middle finger and a portion of the metacarpal bone. The sketch shows the method of applying the straight cutting-pliers for section of the metacarpal bone.

Figs. 4, 5, and 6 represent amputation of the thumb and its metacarpal bone, by the method described at page 696. Fig. 4. The dotted lines mark the incisions, and the thumb as pushed inwards, to relax the muscles, and facilitate transfixion. Fig. 5. The thumb stretched, to render the parts tense as the knife cuts out to the surface, Fig. 6. The wound resulting from the operation.

Fig. 7. Partial amputation of the hand, all the fingers removed, leaving the thumb. The flap in this case was formed from the palmar aspect of the hand.

Fig. 8. Amputation at the wrist, as described at page 697.

PLATE XXI.—Page 700.

Fig. 1. Amputation of the forearm by a long posterior and shorter anterior flap.

Figs. 2 and 3 represent the performance of amputation at the elbow-joint, and the cut surface after disarticulation has been accomplished.

Figs. 4 and 5 show the lines of incision and the flaps as formed in amputation of the upper arm by Mr. Teale's method of rectangular flaps. (From Teale.)

Figs. 6 and 7 represent amputation of the arm by the circular method. In Fig. 7 the edge of the knife is directed obliquely upwards in clearing the bone, as recommended by Alanson.

Fig. 8. Amputation of the arm by anterior and posterior flaps cut by transfixion.

PLATE XXII.—Page 704.

Amputations at the Shoulder-Joint by the deltoid, double lateral flap, and Author's methods.

Figs. 1 and 2. Amputation at shoulder by deltoid flap. Fig. 1 represents the formation of the deltoid flap, and exposure of head of the humerus. Fig. 2. Disarticulation. The assistant grasping the vessels previous to cutting the axillary flap. (After Sir Charles Bell.)

Figs. 3 and 4. Method of amputation by two lateral flaps. Fig. 3 represents the method of transfixion in case of the left arm, and the form and extent of the flap. Fig. 4. The posterior lateral flap formed and reflected. The head of the bone has been disarticulated. The knife is about to cut the axillary flap.

Figs. 5 and 6. Amputation by the author's method, as described at page 704. Fig. 5 represents the flap when formed; the posterior circumflex artery is seen uninjured, except in its small terminal branches. Fig. 6 shows the result when the flap is adjusted.

AMPUTATIONS—LOWER EXTREMITY. --PLATE XXIII.—Page 708.

Figs. 1 and 2 show the lines of incision in amputation of the toes, and in partial amputations of the foot.

Fig. 3. Amputation of the phalanges of the great toe. The internal incision is prolonged far down, so as to obtain sufficient covering for the large head of the metatarsal bone.

Fig. 4. Method of amputating the toe by V-shaped incision.

Fig. 5. Amputation of all the toes at their junction with the metatarsus.

Figs. 6 and 7 represent the formation of the plantar flap in Hey's or Lisfranc's amputation, by transfixion, or by cutting the flap after disarticulating.

Fig. 8 shows the cut surface resulting from the operation.

Figs. 9, 10, and 11 represent amputation at the ankle by Syme's method. Fig. 9 shows the dissection of the heel-flap from the os calcis; Fig. 10, the cut surface of the stump after completion of the operation; Fig. 11 gives the result of such amputation some years after the operation. Page 712.

Figs. 12 and 13 show the lines of incision in Mackenzie's amputation by internal calcaneal flap. Page 712.

PLATE XXIV.—Page 716.

Figs. 14 and 15 represent amputation of the leg by a long posterior flap, by the method described at page 716; and Fig. 16 represents the result of the operation, from sketches taken from nature.

Figs. 17 and 18 are outline sketches of stumps formed by the above method.

Figs. 19 and 20. Amputation of the thigh by double flap. The lower dotted line in Fig. 19 indicates the long posterior flap as recommended by Liston; the upper is the extent of the posterior flap as recommended in the Author's modification of the double flap operation, page 658.

Figs. 21 and 22 exhibit the steps of transfixion and disarticulation in amputation at the hip-joint, as described at page 718.

PLATE XXV.—Page 722.

The patient Robert Davidson. After primary amputation at the hip-joint for injury. See Clinical Cases.

PLATE XXVI.—Page 732.

The patient M. W. Showing result of amputation at the hip by double flaps (as recommended at page 718). See Clinical Cases.

INJURIES OF THE HEAD.—PLATE XXVII.—Page 758.

Fig. 1. Intra-cranial extravasation of blood from injury of the middle meningeal artery, in a case of fissure of the cranium. The symptoms

were at first those of concussion: the symptoms of compression came on rapidly after reaction set in. From original sketch by Dr. James Moore.

Fig. 2. Fungus cerebri* following a compound comminuted fracture of the cranium caused by gunshot. (Case of A. Boswell. See Clinical Cases, page 801.)

Fig. 3 is a sketch of the brain from the same case. A section has been made which exhibits the relations of the fungous protrusion, and the cavity of an abscess, filled with broken-down clots and pus, in the brain-substance at the base of the fungus. (Sketched by Dr. Lauder.)

Fig. 4 shows intra-cranial suppuration, arising from a blow on the cranium. The purulent collection is placed between the bone and dura mater, whilst a collection of unhealthy sanious pus, corresponding to the internal suppuration, is situated externally between the bone and pericranium, constituting Pott's Puffy Tumour. Dr. Caton.

INJURIES OF HEAD, FRACTURES OF THE CRANIUM, AND OPERATION OF TREPAN.—PLATE XXVIII.—Page 776.

Fig 1. Diagram to explain the views of Mr. Vincent as to the direction of the impulses on the contents of the cranium from blows inflicted at different parts of the skull. See page 755.

Figs. 2 and 3 are views of the interior and exterior of a sharply-depressed fracture, supposed to be caused by a blow with a hammer such as is used for breaking stones. The faint dotted line in Fig. 2 indicates the position where the base of the depressed fragment should be sawn across, to enable the surgeon to remove it without using the trephine. See Lecture LXXXIV., page 780.

Fig. 4. Sketch from John Bell's *Surgery*, illustrating the advantage of using the cranial saw instead of the trephine in certain cases. See Clinical Cases, page 807.

Fig. 5. Sketch from Sir Charles Bell, showing the result of the operation of trepan. The plan in this figure shows the fracture from the interior, and its relation to the circle of bone removed to allow of the fragments being removed or elevated.

Figs. 6 and 7 are portions of cranial bones removed by the trephine to exhibit the varying thickness of the cranium in different individuals and in different parts of the same skull.

Fig. 8. Necrosed bone thrown off from the circular opening made with the trepan.

Fig. 9. The instrument termed the trephine.

Fig. 10. The trepan.

TUMOURS OF THE UPPER JAW.—PLATE XXIX.—Page 844.

Fig. 1. Malignant fibro-plastic tumour of the upper jaw, implicating the textures of the cheek. The upper jaw of the right side and a portion of palatine plate of the left side, together with soft textures

of the cheek, were removed by operation. A flap was dissected from the neck to fill up the gap, as shown in Fig. 2. The wound healed well, and the patient was dismissed in good health, with wonderfully little deformity of the face. But a similar growth, I understand, appeared in the left antrum about a year afterwards, in consequence of which she died. (Sketched from nature by Dr. Caton. See Clinical Cases.)

- Fig. 3. Very large firm fibroid tumour of the upper jaw. The tumour, as shown in the sketch, projected very largely into the mouth. The whole jaw was removed, and the patient made an excellent recovery. The result is shown in Fig. 2, Plate XXX. (From original sketch by Dr. John Smith.)

EXCISIONS OF THE JAWS.—PLATE XXX.—Page 845.

- Fig. 1. Sketch of Elizabeth Fitzpatrick, in whom both sides of the jaw were removed, leaving only the symphysis. See Clinical Case, page 909.
- Fig. 2. From a photograph showing the result in the case represented in Plate XXIX., Fig. 3. The contraction of the features, and the deep shadows caused by the light during the photographic process give an unfavourable view of the actual result.
- Fig. 3. From a photograph. Result in the case of Mrs. H., in whom one-half of the lower jaw was removed by disarticulation and resection. In this case also the shadows might mislead as to the extent of the incision, as a deep line extends completely under the chin. The incision terminates considerably to the right of the chin. In other respects the sketch gives a good idea of the result.

TUMOURS OF THE NECK.—PLATE XXXI.—Page 912.

- Fig. 1. A tumour situated in the superior anterior angle of the neck, pressing aside the sterno-mastoid. The tumour really occupied a very deep position, being an outgrowth from the thyroid body. This is one of the cases referred to at page 865.
- Figs. 2 and 3. Enormous deep-seated tumour of the face and neck. Case of Mrs. Jepson. See Clinical Cases. A lateral sketch of the same case is given as a contrast with a malignant cervical tumour at page 376.

PLATE XXXII.—Page 924.

- Figs. 1, 2, and 3. Engraved from photographs of the lad Manson, showing the position of the deep cervical growth and the result of the operation. See Clinical Cases.

DISEASES OF AIR-PASSAGES.—PLATE XXXIII.—Page 898.

Surgical anatomy of the parts concerned in tracheotomy in the child.

- Fig. 1. The skin, platysma, and fascia have been reflected, exposing the sterno-hyoid and thyroid muscles, and the intermuscular line, on

either side of which the central jugular veins pass down to converge in the supra-sternal fossa.

- Fig. 2. Deeper view of the same region. The intermuscular tissue has been divided, and the sterno-hyoid and thyroid muscles are held aside by hooks. At the upper part of the dissection the thyroid cartilage is exposed, less angular and prominent than in the adult. Below it we see the thyroid body, connected with which, on each side, we see the lateral prolongations of the thymus gland. The deep thyroid veins are seen partly overlapped by the thymus gland, and immediately below the isthmus of the thyroid body, and between the veins, the trachea is seen bare at the point where it should be opened in tracheotomy. Externally to the prolongations of the thymus gland portions of the common carotid arteries are exposed to show the close relation of these vessels to the trachea. (Drawn from nature by J. Noble. See page 898.)

TRACHEOTOMY.—PLATE XXXIV.—Page 899.

- Fig. 1. Sketch from nature, showing a plum-stone firmly impacted in left bronchus. Page 875 ; also Clinical Cases, page 931.
- Fig. 2. Sketch from nature, showing occlusion of larynx and upper part of trachea by false membrane. Tracheotomy was performed with marked relief, but the disease extended to the trachea and bronchi below the opening, and proved fatal. See case of D. R., in Clinical Cases, page 942.
- Figs. 3 and 4. The form of trachea-tube recommended.
- Figs. 5 and 6. The double spring hook for keeping the incision open to facilitate the introduction of the tube, or to allow the child to cough up portions of false membrane before the tube is introduced. The instrument is figured closed, and also with the blades expanded.

HERNIA.—HÆMORRHOIDS.—PLATE XXXV. Page 998.

- Fig. 1 exhibits the appearance of parts, in a case of gangrenous hernia, after removal of the mortified portion of bowel. The upper and lower orifices of the intestinal tube are seen, and the valve-like fold of the mucous surface between them. (Case referred to at page 1001.)
- Fig. 2. Portion of gangrenous intestine. A large ulcerated opening is seen at one part below the constriction.
- Fig. 3. Portion of gut with numerous small perforations, resulting from a slower form of gangrene. In this case the patient, an old woman, went on very favourably for some days, when she was suddenly seized with acute peritonitis, which had been caused by the escape of the feculent matter by the minute perforations. Page 992.
- Fig. 4. Hæmorrhoidal protrusion of congested folds of mucous membrane at the anus. This form of disease has sometimes been confounded with prolapsus ani. See page 1189.

HERNIA.—Clinical Case.—PLATE XXXVI.—Page 1047.

View of the parts in a case of femoral hernia, in which the irregular obturator artery constricted the hernial protrusion, and required to be

tied and divided to relieve the constriction. The distal end of the obturator artery is obliterated, and the ligature has separated. The ligature still remains on the proximal end of the artery, which is much diminished in size, whilst the epigastric is proportionately enlarged. See Clinical Cases.

PLATE XXXVII.—Page 1086.

Anatomy of the parts concerned in Lithotomy.

- Fig. 1. Superficial dissection of the male perineum and ischio-rectal region. The pudic artery and its branches are shown on the left side of the plate; on the other side the vessels have been removed to show the pudic nerve and its branches. The line of the lateral incision is indicated by a dark line.
- Fig. 2. Deep dissection of the same parts. The lower part of the rectum, together with all the superficial soft parts, has been removed to expose the prostate and base of the bladder. See pages 1086, 1087.

PLATE XXXVIII.—Page 1094.

Lithotomy—Outline sketches.

- Fig. 1 shows the method of cutting on the curved staff ordinarily used. The course taken by the knife and extent of the prostatic incision are indicated by dotted lines.
- Fig. 2 shows the method of cutting on the rectangular staff. The course taken by the knife and extent of the prostatic incision are indicated by dotted lines.

LITHOTOMY.—PLATE XXXIX.—Page 1095.

- Fig. 1. Patient secured in the position for the operation. The dotted line marks the course and extent of the lateral incision.
- Fig. 2. Lateral view of the perineum and pelvis, showing the position of the knife in cutting into the groove of the staff. The dotted lines indicate the staff and the extent of the prostatic incision. These sketches are reduced from original drawings from nature, by Dr. John Smith.
- Fig. 3. Staff, knife, and forceps, used in the operation.
- Fig. 4. The loop-bandage for securing the wrists to the middle of the foot, as in Fig. 1.



PRACTICAL SURGERY.

OPERATIVE AND REGIONAL SURGERY.

LECTURE LXIII.

INTRODUCTORY LECTURE TO SPECIAL SURGICAL DISEASES AND OPERATIONS :
Necessary Precautions regarding Operations—Preparatory Examination and Treatment of Patient—Points of Detail in reference to collateral Arrangements—Use of Anæsthetics—Hints and Cautions with regard to their safe Administration—Plans for the Operations—Assistants—After Treatment of Patient.

AS introductory to the department of the course which treats of special surgical diseases, and the greater surgical operations, I think it right to bring before you, in a suggestive form, the consideration of certain points which require to be attended to in regard to operations, if we would obviate sources of danger and secure a successful result.

Dexterity, care, and precision, in performing an operation are most important elements of success. But there are other conditions which, if neglected, may mar the success of the most dexterously-performed operation. The conditions I allude to may be embraced and briefly discussed under the following heads:—

1st, The preparation of the patient by suitable preliminary treatment. 2d, The arrangements for the operation. 3d, The use of anæsthetics. 4th, Certain general principles to be attended to in all operations. 5th, The after-treatment.

1. In former times the preparatory treatment of patients about to undergo operation was a very formidable matter. A system of "training" by medical treatment, diet, and regimen, was carried out with extreme care, and so prolonged that it often induced evils of a different kind, but quite as dangerous as those which it was intended to obviate; and hence, as is very often the case, this extreme led to the opposite—the neglect or disuse of preliminary treatment. An operation, however slight or simple it may appear to the surgeon, must always be to the patient a source of great anxiety and distress. When, therefore, an operation is decided on, the less unnecessary delay and suspense the better, as the patient in the interval is liable to become nervous,

depressed, and less fitted for the ordeal. Whilst, however, prolonged preparation is to be avoided, a certain period of delay is necessary in most cases of operation, except in those cases where it is required for the results of injury or other urgent causes. Thus, in the case of patients who are brought from a distance, or those admitted into hospital it is advisable that some days should elapse before they are submitted to operation, not only that a period of rest may be afforded, but also that the surgeon may have an opportunity of carefully examining the state of the patient, and conducting the preparatory treatment accordingly.

In all cases a careful examination of the chest should be made, and the state of the abdominal viscera should as far as possible be ascertained. The condition of the tongue, skin, pulse, alvine excretions, and urine, requires to be carefully attended to. If the skin be hot and dry, the tongue foul, and the secretions unhealthy or diminished, or if irritative fever be present, the operation should be delayed till these conditions have disappeared. Rapidity of pulse, and debility arising from hectic depending on the disease which requires the operation, form no reasons for delay, but rather indicate the necessity for the operation being performed to remove the cause of the hectic. In cases where the urine is albuminous, we should test it frequently, and at different periods of the day, and have due regard to the quantity passed in relation to its specific gravity, to ascertain whether the condition is temporary or persistent, and delay operating until we have thoroughly investigated whether there be any extensive organic disease of the kidneys or not. When there is much lumbar pain, scanty, coagulable urine, accompanied by œdema, the condition is a contra-indication to operation: but by dry cupping and cataplasms over the lumbar region, and the use of diaphoretics, mild diluent drinks, and gentle purgatives, this condition, if it depends on temporary congestion of the kidney, may yield to treatment, and then the operation may be performed with a reasonable hope of success. In cases of disease in which irritative fever or much suppuration has been long present, or in cases of malignant tumours, there is a great tendency to blood-contamination, and hence prophylactic measures to diminish the risk of pyæmia should be had recourse to, before as well as after the operation. The prophylactic remedies in which I have most faith are preparations of iron and chlorate of potash, in moderate or small doses, so that they may mix with the food and enter into the formation of the blood. If given in large doses they simply irritate the bowels, and are rapidly carried off by the bowels and kidneys.

In performing operations on females, we should studiously avoid the catamenial period, and if present wait till it has passed. The patient is generally more excitable and irritable during the menstrual period; and even in cases in which operations have been performed previously, an unfavourable change is often noticeable during that period, healthy action in the wound being restored as the discharge ceases. At the same time, whilst it is well to observe this precaution in ordinary cases, the presence of the catamenia should never be a bar to the performance of operations of urgency. Whilst I have thus instanced some of the

conditions to be specially attended to, in a large proportion of cases all that is required is to give the patient some gentle alterative, or a mild purge a day or two previous to the operation, and to regulate his diet, so that the digestive organs may be in a favourable state.

2. ARRANGEMENTS FOR THE OPERATION.—In hospital practice a theatre, designed with a special view to the performance of operations, well lighted, and furnished with suitable tables, and all other appliances, together with the existence of an organised staff of medical assistants and nurses, render the arrangements for operations so methodical, simple, and apparently routine, that the requisite details and the forethought required in making the arrangements are scarcely noticeable to students who witness operations. Hence I consider it the more necessary to draw your attention to what forms a most important condition for the proper performance of an operation, and specially so in private practice, where everything must depend on the forethought and careful directions of the operator. In all cases of operation, not arising in emergencies, it is desirable that the proper arrangements should be made beforehand, so that nothing be left to be done in the confusion and excited state in which a private family generally is on the day of the operation. As all the necessary requirements are simple and easily obtainable, the arrangements can be made without any parade or alarm to the patient, whilst much time and annoyance is thereby saved both to the family and the operator. If the bedroom of the patient be tolerably large and well-lighted, it is advisable that the operation be performed there, as appearing less formidable than transporting the patient into another room. In all great operations I consider it most essential that the patient be placed upon a table to undergo the operation. This enables the operator and his assistants to act more easily in concert, to obtain better light, and to get rid of all appearances of the operation when it is completed; and, what is my special reason, it secures greater safety to the patient. Some object to this as unnecessary, and say that in most cases the operation had better be performed in bed, as less disagreeable to the feelings of many patients, and as causing "less fuss." Now, my experience is, that eventually it always causes "more fuss." It is not easy to get at the patient; the assistants get crowded and awkwardly placed, blood can hardly be prevented soiling the patient's night-dress, and the bed-clothes and the bedding generally get disarranged, so that the after comfort of the patient is interfered with. All this and more serious consequences are avoided by placing the patient on a table, and there is no need for him knowing anything of it. He is put under chloroform in bed; the table is easily arranged in another room, and brought in when the patient is unconscious, and he is lifted from bed and placed on the table. His bed is then properly arranged, so that he is afterwards placed in as comfortable a condition as his circumstances admit of, and after the operation, the table and all the other paraphernalia of the surgeon are at once removed. Supposing the room to be fixed on,—the surgeon chooses a firm table, of moderate height, not very broad, and of sufficient length to support the patient. An ordinary stout deal table generally answers all purposes. This table is

covered by a folded blanket, protected by oil-cloth or india-rubber webbing, and furnished with a couple of pillows to support the patient's head. A piece of floor-cloth or old carpet should be placed over the carpet of the room, under and for some distance from the table; to protect the carpet from being stained with blood. In cases of amputation, where there may be considerable effusion of blood, or discharge from the diseased limb, the surgeon should direct the friends or nurse to provide a tray with sawdust, so as to avoid all disagreeables as far as possible, as the sawdust absorbs the fluids, and prevents the risk of their accidental diffusion over the floor. If, however, attention be paid to the direction given under the head of bloodless surgery, these unpleasantnesses may be avoided. The other preparations to be provided by the family are basins, in which to wash the sponges; and plenty of towels, hot and cold water, and a foot or slop pail, into which the soiled water may be emptied. Hot bottles should be ready when the patient is replaced in bed after the operation. The surgeon should never trust to finding sponges provided; he should invariably bring his own, otherwise he will sometimes have to deal with very doubtful articles. In my own practice, I am very particular in regard to sponges. Before being used they should be thoroughly cleansed from all sand or calcareous matter, and after every operation I have my sponges washed in a weak solution of bicarbonate of soda, to remove the blood thoroughly, then in cold water, and lastly, I allow them to steep for a night in a weak mixture of water and hydrochloric acid, and in my private practice I seldom use the same sponges continuously, or for any long period. The number of assistants required will depend upon the nature of the particular operation. In cases of emergency we must do the best we can with what assistance can be procured, but in pre-arranged operations the surgeon should consider what assistance is required, and arrange the number of attendants and their duties beforehand. Whilst there is no necessity for a large number of assistants, there is often an error committed in having too few, and trusting to unskilled aid, which sometimes fails when most wanted. The patient need never see any one but the operator, and the assistant who administers the chloroform. When he is under the chloroform the other assistants are introduced to lift the patient upon the table, and take the places previously assigned to them. By a little forethought and preconcerted action much bustle is saved. The instruments and dressings required in the operation are prepared beforehand, and arranged on a small tray in another room, whilst the patient is being chloroformed. As a general rule, it is advisable that the after-dressings, ligatures, suture-needles, and the like, be placed on a separate tray from the instruments used during the operation. For night operations small wax tapers should be at hand, as being more manageable and giving a clearer light than a flaring candle. I have found these tapers so useful that they form part of the furnishings of my emergency bag.

3. THE USE OF ANÆSTHETICS is now almost uniformly adopted in all important operations, and the cases in which they are objectionable are so very few and exceptional that they will be better understood when speaking of special operations. I do not intend to enter upon

the general question of anæsthesia and anæsthetics ; that has been so fully discussed by my late distinguished colleague, Sir James Simpson, that I need only state what I have found to be the most efficient and safest method of exhibiting them in cases of operation. I would, however, observe, as regards their risks, that whilst we could scarcely expect that an agency so potent as to dull or arrest temporarily all consciousness, should be perfectly free from danger in some cases, or if not carefully watched in its action ; yet, when we take into account the many thousand cases in which anæsthetics must have been administered, and the comparatively few cases in which fatal results have occurred, I think we may safely say that few powerful narcotic remedies are so free from danger. And it has been frequently remarked that the great majority of the fatal results have occurred during the performance of slight operations, and when the patient has been placed in the sitting posture. At the same time, all due precaution should be taken, such as examination of the circulatory organs in suspected cases, and preparation of the patient prior to the operation. When the patient has a weak heart and feeble pulse, or is advanced in life, I usually mix a little anhydrous sulphuric ether with the chloroform, or begin by the administration of chloroform, adding the ether if the pulse shows a tendency to flag. The stimulating effect of the ether under such circumstances is very noticeable : although, for general use, the chloroform answers far better.¹ As to the quantity to be administered, that must be judged of by the effect. I would only remark that there is often greater danger from beginning with small quantities than by bringing the patient rapidly under its influence. Measurement of the chloroform used, is merely to give an appearance of precaution, and, I presume, to enable the surgeon to be prepared for a coroner's inquest.

In the Edinburgh Infirmary no special apparatus is employed ; merely a folded towel or handkerchief ; or, when the "drop system" is adopted, a single fold of the handkerchief or cloth is placed over the mouth and nostrils, the face having been previously smeared over with lard or oil to prevent the skin being irritated. When the ordinary method is employed, the handkerchief is folded into a hollow cone, into which the chloroform is poured so as to wet the interior, and the cone is then placed over the mouth and nostrils. When renewing the supply of chloroform in this method, it is advisable not to remove the cone from the mouth, but merely to open up a part of the outer fold and pour the chloroform on the inner fold. When the "drop system" is used, a little chloroform is poured on the handkerchief at first, and then continuously applied drop by drop, till the full effect is produced. When a patient is to be operated on under the influence of chloroform, no food should be given for at least three hours before the operation, so as to allow the stomach to be empty, and thus diminish the inconvenience and risks of vomiting. A little brandy, diffused in a small quantity

¹ A great clamour has recently been raised about the dangers of chloroform and the advantages of ether, but after a very extensive experience of the use of chloroform since its introduction in 1847, and having had personal experience of the effects of both these anæsthetics, I see no reason to alter the opinion expressed above.

of water, may be taken about a quarter of an hour before the chloroform is inhaled. This is useful both as a stimulant to the circulation and also in obviating flatulence, which is apt to occur in some patients when the stomach is empty, and, when present, leads to retching and attempts at vomiting. In the Royal Infirmary, where the usual hour for operations is twelve o'clock noon, the patient gets a light breakfast about a quarter to eight o'clock, so that fully four hours elapse before the anæsthetic is administered. I have spoken of the *risk* of vomiting, for there is great risk of a portion of the vomited matter passing into the larynx, and leading to suffocation as the symptoms of asphyxia might be attributed to the chloroform, and time lost in attempting artificial respiration. In cases of hernia, where vomiting is present independently of the effects of the anæsthetic, great attention is required on the part of the assistant to keep the patient's head and neck lying on the side, so as to allow the vomited matter to pass easily from the mouth, which it cannot do when the head is lying back. When, after an attack of vomiting, sudden symptoms of asphyxia occur, I think the proper plan would be at once to perform laryngotomy in the crico-thyroid space, and allow air to enter the trachea; because, if any solid matter has entered the larynx or trachea, the peculiar sensory and expulsive powers being diminished during anæsthesia, the foreign body is not expelled, as it might be under ordinary circumstances.

In all cases of important operations the patient should be placed recumbent. All articles of dress, which constrict the neck or waist, or may in any way impede the free movements of the chest or abdomen, should be loosened or removed. The state of the pulse should be ascertained before beginning the inhalation, and carefully watched throughout. Immediately before applying the chloroform, the patient is desired to take a deep inspiration, and then to continue to draw in full breaths quickly after the chloroform is applied. By doing this, less chloroform is required to produce the desired effect, and the assistant administering it watches carefully the effects produced. In almost all cases there is more or less struggling just before the patient gets fully under the effect of the anæsthetic. Then the breathing becomes stertorous, but regular; the eye and eyelid insensible to the stimulus of touch, and the limbs become flaccid. The symptoms which indicate danger are—extreme lividity, irregular gasping breathing, but more especially pallor, and irregular weak pulse, or sudden cessation of the wrist pulse. Stertorous breathing, so long as the respirations are regular, is not necessarily a symptom of danger, it merely shows that the patient is deeply under the anæsthetic. The chloroform cloth may be removed to a greater distance from the mouth to allow free admixture of air, or its use may even be intermitted; but unless the breathing be irregular, or becomes stridulous or gurgling, with increased lividity of the face, there is no need to interfere.

When the breathing becomes irregular, gasping, gurgling, or very stridulous, and the face livid, remove the chloroform, draw forward the tongue, pass the finger into the mouth to clear away any mucus over the glottis, push away ~~the~~ uvula and soft palate upwards to avoid its interference with the opening of the larynx, and sprinkle cold water

on the face and chest, or flip the surface with the end of a wet towel. At the same time, artificial respiration, by means of gentle and regular pressure on the walls of the chest, not too forcibly or rapidly applied, should be used; or the same end may be effected by the assistant drawing the arms upwards above the head, and then pressing them down by the sides of the patient, so as to make alternate compression and expansion of the parietes of the thorax. Whenever the lips or face are seen to become pale, and the pulse to flag in strength, or to become irregular, the chloroform should be stopped, and sulphuric ether substituted, cold water sprinkled on the face, and artificial respiration begun. The case is one of imminent danger. Whilst these means are being used, a small enema of brandy and warm water, or the subcutaneous injection of ether, should be administered as a stimulant. If the patient be carefully watched, and the administration of the ether begun when any weakness of pulse is noticed, it will generally suffice to restore the force of the circulation, and prevent the accession of the dangerous symptoms. Galvanism has been recommended and used. If applied, the current ought not to be directed through the chest, so as to affect the heart, or it may do more harm than good. It should be applied to the cervical region, so as to pass along the course of the phrenic nerve. But I should hardly advise its use, as it is likely to interfere with the other and more efficacious measures for resuscitation of the patient. Should the face be congested and the superficial veins be prominent, mechanical relief of the distended right side of the heart by venesection at the external jugular vein has been recommended, and may occasionally be practised with benefit in such cases, but this measure is not to be adopted as a matter of routine practice unless special indications exist necessitating its performance.

In my own practice I have met with one fatal case resulting from chloroform. The operation—amputation of the penis—was effected with one stroke of the knife. No blood flowed, the pulse at the wrist had ceased in an instant, and all efforts to resuscitate failed. Breathing, though of a gasping character, was present when the artificial respiration was commenced. In another case, in which I was assisting, I had my finger on the posterior tibial artery. The patient was just brought under the chloroform, and the operator had entered the knife through the skin, when the pulse, without any previous diminution in strength, ceased to beat. In both these cases there was fatty heart. I have, however, both in my own practice and that of others, seen some patients, who seemed to be in a fatal syncope, resuscitated by the measures I have advised. Almost all the cases in which the dangerous symptoms occurred were cases of slight operations. But, after all, the risks are very small if the administration be watchfully and properly carried out.

As to its after-effects, the worst are the nausea and vomiting which often result from its employment; and in some operations, such as hernia, this vomiting may prove serious. In most cases, sucking a little ice, or a dessert-spoonful of iced brandy and water, given occasionally, and the application of a sinapism over the epigastrium, serve to relieve the sickness. When the nausea and retching

continue, a draught of tepid water, to assist the effort of vomiting* to empty the stomach, is often of use, and this may be followed by a small opiate to allay irritation and procure rest. It has been stated that whilst the use of chloroform and other anæsthetics has done so much to facilitate the performance of operations and save the patient from suffering, they have given rise to greater danger after the operation, that the mortality is increased, that cases do not get on so well as formerly, and that pyæmia especially is much more heard of now than before anæsthetics were used. All this is mere assertion, without any distinct proof. And as I have had experience in performing and witnessing operations both before and since the use of chloroform, I feel satisfied that the very opposite is true; that operations are very much more successful in their results than before the use of anæsthetics. The patient is saved both the physical and moral shock inseparable from great operations formerly, and which depressed him and exercised an influence for evil on the result. I was amongst the first to use chloroform in a great operation in November 1847; and since then I have used it, and seen it used, in almost all operations, great or small. I feel satisfied that, instead of diminishing, it has greatly advanced the successful results of operations. It is true, we hear more about pyæmia now than we did thirty or forty years ago, because the name is comparatively a new one; but the same condition existed under different titles:—"exhaustion," "surgical fever," "secondary abscesses," "icteric irritative fever after operations," "rigors," from exposure at open windows (a condition once remarkably fatal in "successful cases"), and "acute sinking,"—all these will be found to correspond wonderfully in symptoms, results, and morbid appearances, to the modern pyæmia. Indeed, it is only of very recent date that some surgical authorities have admitted the term pyæmia into their vocabulary—"exhaustion," or "acute sinking," having been found to answer all purposes equally well.

4. THE OPERATION.—The general principles to be attended to must be very briefly stated here, for so much depends on the nature of the operation that they are better brought out in their relation to special operations. The plan or method of operating should be carefully considered and decided on beforehand, so that the incisions may be effected rapidly (not hurriedly), with decision and precision, every touch of the knife telling towards the accomplishment of the object in view. If the plan be not decided on, confusion, and a want of decision, in operating, and loss of time, will be the almost inevitable result. If the steps of the operation be duly planned beforehand, all will be executed with decision, simplicity, and safety to the patient. The assistants should have their several duties assigned beforehand, and their places arranged, so that they may not interfere with the operator, or each other, but that all may act in concert. The incisions should be free, deep, and directly from the surface towards the deeper parts, without lateral dissection, except in particular operations, such as those for the removal of tumours. In certain operations where it is important to recognise readily the deep textures, such as in hernia, ligature of arteries, or in the removal of some tumours, it will save time in the end to pause and secure the small vessels which bleed, so as to prevent

oozing of blood into the deep part of the wound, which, by infiltrating the cellular tissue, renders it difficult to recognise textures. Besides, small vessels, which are easily seen and tied at first, soon cease to bleed actively during the operation, and are consequently often left unsecured, and bleed again on reaction taking place; and in cases of hernia, or in other operations near the great cavities or canals, they may bleed into the cavity and give rise to serious risk. When the operation is completed, the wound should be washed by pouring first tepid and then cold carbolised or boracic acid water, from a jug, over its surface, to remove all clots and arrest oozing. The edges of the incision are then approximated by points of interrupted suture, or harelip suture. In some cases we only introduce the sutures, leaving the ends long, without tying them, so that if any oozing occurs it may be noticed and arrested. After six or eight hours, any clots of blood which may have formed are gently removed with a bit of soft sponge, and by syringing out the wound, and then the incision is finally closed, and the local treatment conducted on the principles laid down when speaking of incised wounds (Lecture XII.)

5. CONSTITUTIONAL AFTER-TREATMENT.—When the patient awakes from the chloroform, an opiate is given to allay pain and to prevent the restlessness which would otherwise be sure to take place. Should sickness from the chloroform supervene, as already stated when speaking of anæsthetics, I advise the use of tepid water to render the efforts of vomiting less violent, and to empty the stomach, and then a little brandy in iced water may be given. If the nausea continue, a sinapism applied to the epigastrium, and a little ice kept in the mouth and slowly sucked, or small quantities of iced aerated water, will usually arrest it. In some cases, where the patient does not vomit, the nausea may continue for some time, and, unless attended to, may prove troublesome by depressing the patient. During the progress of the case opiates are given at bed-time, if required to obtain sleep, but the sooner we can dispense with their use the better. In some patients, in whom there is much nervous excitement, the use of the bromide of potash, in 30-grain or 40-grain doses, at bed-time, is often of great service in procuring sleep, and enabling us to dispense with opiates. As to diet, it should be simple, light but nourishing, and given at first in small quantities, frequently. For a day or two it is probable the patient may not be able to take anything but milk diet. Milk beat up with the white of eggs and a little lime-water will often remain on the stomach when all other food is rejected, and milk with aerated potash water is also much relished by patients. So soon, however, as the patient can bear it, strong beef-tea, with extract of beef, should be given, or a little white fish, and afterwards, as the appetite improves, chop or steak is preferable to slop diet. As regards the exhibition of stimulants, that must be regulated by the condition of the patient, the state of the pulse, and the appearance of the wound. No routine practice should be followed. In my hospital practice I find myself forced to give stimulants largely, owing to the exhausted state of the patients, their inability to take nourishing food, and not unfrequently from their previous habits, or from want of action in the wound. In

private practice stimulation is not often needed, and I feel satisfied that the routine practice of giving stimulants in all cases of great operations is not only unnecessary but dangerous, as over-exciting the circulation, keeping up the pulse, and proving detrimental to internal organs. If the patient has a moderately firm pulse, and can take nutrient diet, the amount of wine or brandy he requires is very little, if any.

Should the pulse keep high and of fair strength with increase of temperature, or show a tendency to rise, the remedy of all others which I have found of most use as counteracting this condition, and relieving the fbrile state which accompanies it, is the tincture of aconite (*Fleming's*) in half minim or minim doses, every three or four hours, watching its action carefully, and leaving off its use whenever the pulse lessens in frequency. When the temperature rises and the patient is debilitated, large doses of quinine, either alone or with salicylic acid, should be administered; should the salicylic acid be used, it is better administered by enemata, on account of the irritation it produces. In using these remedies the effects upon the heart should be carefully watched. During the after-progress of the case, when the tongue is clean, the use of quinine with compound infusion of gentian, and either dilute hydrochloric, nitric, or nitro-muriatic acid, will be found of use as tonics; and in cases where there is any want of action in the stump, the exhibition of such tonics is often attended with marked benefit. In very weakly strumous patients, or where, from the nature of the disease requiring the operation, we dread pyæmia supervening, the muriated tincture of iron, and moderate doses of chlorate of potash, may be given; but should the iron produce nausea it must be abandoned. Of course the state of the bowels and the urinary secretion must be carefully attended to during the progress of the case; and at first, shortly after the operation, the action of the bowels should be assisted by enemata to prevent straining; and, after ligature of great arteries, or in the larger amputations of the lower extremity, the same precaution should be used at the period when the main ligatures may be expected to separate.

LECTURE LXIV.

Operations for the Ligature of Arteries—Importance of a Knowledge of the Relative Anatomy of the Part to be operated on—Nature of the Incisions required—Exposure of Artery : Opening of Sheath—Passing of Needle—Apparatus required. Ligature of Innominate Artery—Ligature of the Common Carotid Artery.

As I have formerly discussed the effects of ligature of arteries, and the injuries and diseases of the arterial system which require surgical treatment, I now proceed to describe and demonstrate the operative procedures for applying the ligature to the principal arteries. It is not my intention to describe the various methods which have been adopted by different surgeons, but rather to employ the time allotted to this part of the course to careful and accurate demonstration of the points most essential to be attended to, in what, from experience, I have found to be the best plans of procedure. In every surgical operation a thorough knowledge of the structure of the parts to be operated on is necessary ; but in very few operations is it so necessary as in those performed with the view of reaching and tying important arteries. In these operations it is generally amongst organs of vital importance that the surgeon has to dissect, so that by carelessness or the least deviation he may wound structures essential to life. And in all cases, uncertain and difficult manipulations, if they do not lead to immediately fatal accidents, are almost sure to be followed by secondary hæmorrhage.

Surgical anatomy, consisting of an accurate knowledge of relative anatomy, and of the functions of the different structures likely to be implicated in the operation, is the only secure basis on which to practise the operations on arteries. And I shall therefore preface each operation by a brief but careful examination of the anatomy of the parts, in so far as these have essential bearings on the operative procedure ; whether as affording guides to the vessels to be tied, at different stages of the operation, as enabling us to avoid injury to important structures, or as facilitating the deligation of the artery.

When speaking of operations in general, I stated that the operative manipulations would be better understood when speaking of special operations. I shall now, therefore, state what I consider are the points to be principally attended to in operations for ligature of arteries.

The great object in view is to expose the artery to be tied with the least possible disturbance of parts, more especially of those parts immediately surrounding the vessel, so as to avoid the risk of second-

ary hæmorrhage. This object is best accomplished by cutting down directly from the surface towards the vessel, avoiding as far as possible all lateral dissection or separation of the superimposed textures. The superficial incisions should be free, so as to diminish the depth of the wound, and, with a few exceptional cases, this free division of the superimposed textures should be applied to the deeper fasciæ and structures covering the sheath. If this principle be not attended to, the wound becomes more and more contracted as the operator proceeds deeply, till at last, and at the most important stage of the operation, he will find himself working in a deep hole, in which his manipulations are confined, and the textures only imperfectly seen or felt. By attending to the rule of free division, the oozing of blood gets vent externally, the parts are fully exposed, and their position rendered less deep. Even as regards the sheath of the artery itself, opening it somewhat freely, or cutting out an oval portion of it on its superficial aspect, will entail no danger, if the operator is only careful not to separate it largely in clearing the circumference of the artery for passing the ligature. During the incisions all bleeding vessels should be twisted or tied, to avoid the blood infiltrating the textures in the wound. In opening the sheath of the artery the surgeon should carefully raise a portion with his dissecting forceps, and then either slit it open for about a quarter of an inch, or, placing the edge of his knife horizontally, cut out an oval portion of the sheath to the same extent. He should next carefully separate the margin of the sheath, and fix it by seizing it with a pair of artery forceps which are left on until the vessel is cleared and the deligation completed. This little manoeuvre prevents the original opening of the sheath being lost sight of, should the patient move or the parts get displaced, and it also does away with the necessity for the fingers of an assistant to hold aside parts. The mode of applying the forceps to the edge of the opening in the sheath will be understood by reference to the sketch of the ligature of the femoral artery.

When the sheath is thus opened, the surgeon, with the point of the scalpel, clears the circumference of the artery to the extent of a line or two in breadth, so as to admit of the aneurism needle being passed without any force. In passing the aneurism needle, the handle should never be forcibly depressed with a view to make its point project, for that elevates the artery from the sheath and breaks up its fine vascular connections. The needle should merely be insinuated below the vessel, till its point is seen on the opposite side, and then the thread is seized with the dissecting forceps and held whilst the needle is withdrawn, so that all unnecessary disturbance of the artery is avoided. After ligature of the great arteries supplying the extremities, the wound is merely covered with a piece of protective, and over this a fold of lint, supported by strips of adhesive plaster, or dressed by the antiseptic method or a modification of it, and the limb then enveloped in a sheet of cotton wadding, and laid on a water pillow or some soft cushion to avoid pressure.

The apparatus required for ligature of arteries is very simple. Besides the ordinary dressings, sponges, and other requisites for all

operations, the special instruments needed are a sharp-pointed scalpel or small bistoury, a probe-pointed bistoury, which may occasionally be required; dissecting forceps, artery forceps, Pæan's forceps, and torsion forceps; blunt hooks or bent metallic spatulæ for holding aside the textures; an aneurism needle, armed with fine carbolised ligature silk or catgut.

Some surgeons, more especially on the Continent, use a grooved director on which to divide the fascial textures and the sheath, but it really affords no safety, and ought to be dispensed with, as the fasciæ in the important parts of the operation are better divided with the hand unsupported and uninfluenced by a mechanical guide.

The aneurism needle should be of the ordinary form, the point rather short from the curve. The eye of the needle should be near the point and well finished, so as not to cut or fray the ligature. The point of the needle should be smooth and blunt, but not thick, so that it may be easily passed under the artery without risk of piercing the neighbouring vein or other important texture. For the ligature of some deep-seated arteries—as, for example, the subclavian—when the shoulder and clavicle are much elevated, either Deschamps' needle or a needle with a double curve may be required, the concavity of the curve nearest the handle playing on the clavicle, so as to enable the point to be passed more easily round the artery, that it may appear at the opposite side without raising the vessel from its connections. If the ordinary aneurism needle, however, be so tempered as to allow some slight degree of flexibility, the surgeon can curve it to suit particular cases. I have always had my own aneurism needles constructed on this principle, and also grooved behind the eye to receive the thread. Not that I consider this of any consequence, but finishing off the groove necessitates care in finishing the eye of the needle, which I have often seen a mere rough perforation.

In cases in which we are about to apply the ligature to an artery for true aneurism, we must be careful, whilst bringing the patient under the influence of chloroform, to compress the vessel nearer the heart; for, when the patient struggles, and the muscles become rigid, the sac often becomes so tense that there might be a risk of its rupture taking place unless such precaution were taken.

I shall first describe the operations for ligature of the principal arteries supplying the head, neck, and upper extremity, and afterwards those of the abdomen and lower extremity.

THE INNOMINATE ARTERY, though deeply seated, is not so complicated in its relations but that it can be readily reached and tied. The vessel is very short—not much more than about an inch and three quarters in length. It arises from the right side of the arch of the aorta, and passes obliquely upwards, as far as the right sterno-clavicular articulation, where it ends by dividing into the right subclavian and the right carotid arteries. It is sometimes called the brachio-cephalic artery, from the distribution of its terminal branches. In its upward course the artery rests for some little distance on the trachea, and is covered by the first bone of the sternum, and by the sterno-hyoid and sterno-thyroid muscles. In this substernal region the artery is crossed by the vena

innominate of the left side, which is formed by the junction of the left internal jugular and subclavian veins. Higher up, in the cervical region, the vena innominate does not cover it. The artery then passes into the lower part of the cervical region, and a small portion of it can be seen by separating the sterno-hyoid and sterno-thyroid muscles. The vessel here lies very deeply, though the textures between it and the surface are not numerous. These are the skin and fascia, with the sterno-mastoid, sterno-hyoid, and sterno-thyroid muscles, and a quantity of loose cellular tissue. It is this part of the vessel that we reach by tracing downwards from the right carotid artery. Its surface corresponds to a quantity of loose cellular tissue and glands, in which lie several large veins returning from the thyroid body. These thyroid veins form

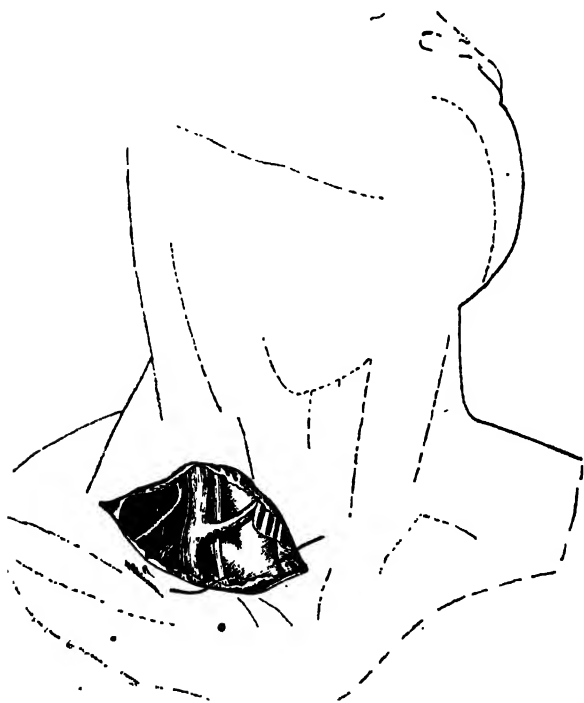


Fig. 136

a sort of network over the upper part of the space in which the artery lies. The innominate artery is also related to the right vena innominate—the vein being to the right side of the artery; and in close contact with the right side of the vessel is the right pleura.

Operation.—An incision, about two inches long, is made over the inner part of the clavicle, towards and over the sterno-clavicular articu-

Fig. 136. Incision at root of neck exposing the parts concerned in the operations for ligature of the innominate, first part of subclavian, and origin of carotid arteries.

lation, and another, two and a half or three inches in length, along the internal margin of the sterno-mastoid muscle, at its lower part, to meet the former, where it terminates at the sternum. The skin, fascia, and inner attachment of the sterno-mastoid are then detached without dissecting them from each other, so as to be thrown backwards in the form of the flap marked out by the incisions. The internal jugular vein and the root of the right common carotid artery, covered by the deep fascia, are now brought partially into view. The sterno-hyoid and sterno-thyroid muscles should next be cut across, so as to expose the deeper parts more fully. The head should be drawn somewhat back, as this allows the innominate artery to be drawn up into the neck, while the left vena innominata, which covers the artery, being fixed by its relations to the right vena innominata and superior vena cava lower down, can scarcely be dragged above the sternum into the right side of the neck. A little deeper dissection is then made, and the artery cleared from the surrounding textures. In doing this great care must be taken to avoid the lower thyroid veins and the right pleura, which lies below and to the right side of the vessel. The needle is then passed below it, still taking care to avoid injuring the pleura.

The operator should gently trace the surface of the vessel till he distinctly feels its bifurcation, so as to make sure that the artery exposed is the innominate and not the lower part of the carotid, or in case of any irregularity. In performing the operation on the subject before my class on one occasion, and inculcating the same precautions as I do now, I could not feel the bifurcation. I therefore desisted from farther interference, and had the subject injected. The preparation is now on the table, and you will perceive that there is no innominate trunk. The right subclavian arises from the left side of the arch of the aorta, passes between the œsophagus and vertebræ, and so arrives at the right side of the neck. When there is any difficulty in reaching the innominate, you will find it by tracing the right carotid down to its origin,—the simplest and surest method of reaching the trunk common to it and the right subclavian.

THE COMMON CAROTID ARTERY has been so repeatedly tied for aneurism, erectile tumours, and other causes, that no one would now hesitate to tie it from any fear of the effects which the operation may have on the cerebral circulation.

Although the anatomical relations of the right and left carotid arteries are very different in the first part of their course, owing to the difference in their mode of origin, yet, in the cervical region, where the surgeon has to deal with them, these differences almost disappear. In the lower anterior triangle of the neck, the right common carotid is more superficial than the left, owing to its origin from the innominate trunk, which lies in front of the trachea, whilst the left carotid in this region has a closer relation to the œsophagus on its internal aspect, and at the very lowest part of the cervical region the thoracic duct corresponds to its external side. But in other respects, and higher up in the neck, their relative anatomy is very similar.

The general course or position of the common carotids in the neck is

indicated by a line drawn from the sterno-clavicular articulation to a point nearly midway between the angle of the lower jaw and mastoid process. The vessel divides into its great terminal branches, the external and internal carotids, at a point a little higher up than the upper margin of the thyroid cartilage. In the neck the primitive carotid artery is inclosed in a common sheath, which contains the internal jugular vein and pneumo-gastric or vagus nerve. This common sheath rests upon the front of the cervical vertebræ, and more immediately upon the longus colli muscle, and, higher up, upon part of the rectus capitis anticus. Between the sheath and these muscles there is a quantity of fine connective tissue, which permits of free movement of the parts lying in front of the vertebræ. The cervical portion of the great sympathetic nerve also corresponds to the posterior aspect of the common sheath. On the mesial side of the sheath are the larynx and trachea, the lower part of the pharynx, and the œsophagus—the last-mentioned structure being more directly in relation to the left than to the right carotid. The superior and inferior laryngeal nerves pass behind the sheath in the course which they take towards their destination, and the inferior thyroid artery also crosses behind the sheath and then corresponds to its inner aspect. Still more deeply, at the lower part of the neck, a chain of lymphatic glands lies to its inner side. On its outer or distal side the sheath is in relation with the origin of the scalenus anticus. The common carotid artery, vagus nerve, and internal jugular vein, whilst included in the common sheath, lie each in a separate compartment; the septa between them being pretty strong and distinct, more especially as regards the compartment which contains the artery, so

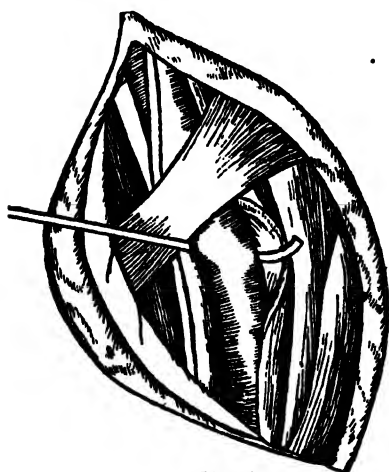


Fig. 137.

that we may expose the carotid without interfering with the vein and nerve. The artery lies in the inner compartment, *i.e.* nearest the mesial line of the body. The internal jugular vein lies most external, whilst the vagus lies between, and on a plane posterior to both. At the root of the neck, on the right side, the nerve is more exposed between the vein and artery, from the somewhat oblique upward course which the latter takes from its origin from the innominate. The coverings of the sheath vary at different parts of the neck. In the lower anterior triangle we have the skin, superficial fascia, and a few of the lower and

inner fibres of the platysma; the layer of the deep fascia covering the sterno-mastoid and the inner head of that muscle, the sterno-hyoid and thyroid muscles, and the deeper layer of the cervical fascia from which the sheath is derived. Immediately above this point the sheath

Fig. 137. Diagrammatic view of the relative anatomy of the common carotid artery above and below the omo-hyoid muscle.

is crossed by the tendon and anterior belly of the omo-hyoid muscle, which passes from below, upwards and inwards, to reach the body of the hyoid bone, and forms the boundary between the superior and inferior carotid triangles of the neck. If we draw aside or divide the omo-hyoid, we see the lateral lobe of the thyroid gland, which generally overlaps the inner surface of the sheath. Above the point where it is crossed by the omo-hyoid muscle, the common sheath is only covered by the skin, platysma, and the superficial and deep fasciæ of the region. Branches from the superior thyroid artery to the sterno-mastoid muscle cross it obliquely from above, downwards and outwards. The descending branch from the ninth cranial nerve passes down in front of the sheath and a little above the point where the omo-hyoid crosses the sheath, this nerve forms a loop-like junction or plexus with the anterior branch of the second cervical nerve, the branches from which pass to the tracheal muscles. In many cases, however, the "*descendens noni*" is covered in by a layer of the sheath at the upper part of the neck.

The anastomoses to which we trust for re-establishing the circulation, after ligature of the common carotid, are so numerous, that we need have no anxiety on that point. We have—1st, The anastomosis between the superior thyroid branch of the artery which has been tied with the thyroid of the opposite side, and both also anastomose freely with the inferior thyroids of the subclavian. 2^d, The lingual, on the side tied with that of the opposite. 3^d, The anastomosis between the facial arteries. 4th, The inosculation between the occipital arteries of opposite sides, and of the occipital with the vertebral. 5th, The terminal branches of the external carotid—viz. the transverse facial, internal maxillary, and superficial temporal arteries—anastomose freely with the corresponding vessels of the opposite side; whilst, as regards the cerebral circulation, we have free anastomoses between the vertebral arteries and the internal carotids, through the circle of Willis within the cranium.

Operation.—The operative procedure adopted for tying the common carotid artery has never undergone much variation. An incision, at least three inches long, is made along the inner margin of the sterno-mastoid muscle, commencing higher or lower in the neck according as it is our intention to tie the vessel above or below the omo-hyoid. As the general course of the common carotid is indicated by a line drawn from the sterno-clavicular articulation to a point a little behind the angle of the lower jaw, whilst the anterior margin of the sterno-mastoid is indicated by a line from the sterno-clavicular articulation to the anterior margin of the mastoid process, it follows that as the vessel passes higher in the neck, the muscle diverges from the artery and corresponds rather to that part of the sheath containing the jugular vein, than to the compartment enclosing the carotid. Hence, in tying the artery above the omo-hyoid we should make our incision nearer the mesial line, more directly over the line of the vessel, and not follow closely the oblique line of the margin of the sterno-mastoid.

The patient should be placed with the shoulders moderately raised, the head supported by a pillow, the neck slightly stretched, and the

face turned to the opposite shoulder, so as to make tense the sterno-mastoid. The surgeon should next compress the neck at the lower part, to make the superficial veins turgid, and thus ascertain their course in each individual case, so as to avoid them, or tie them previously to dividing them if necessary.

Having indicated this precaution as requisite in the living, I now make an incision in the line previously described, through the skin, platysma myoides, and superficial fascia. Commencing on a level with the upper part of the thyroid cartilage, I carry the incision downwards for three inches. When the skin and platysma are fully divided, my incision brings into view the deep fascia.



Fig. 138.

That structure I next divide along the anterior edge of the sterno mastoid, in the line and to the full extent of my superficial incision. This exposes the margin of the sterno-mastoid. A few light touches with the point of the knife divide any resisting connections, and with the ivory handle of the scalpel I now gently separate the loose cellular tissue, so as to enable me to draw the overlapping edge of muscle slightly aside by a blunt hook. You now observe a layer of the deep fascia covering in and binding down the omo-hyoid and other tracheal muscles and sheath of the vessels; the sheath being covered merely by this fascia at the upper part of the incision. I proceed to divide this fascia by raising a portion of it over the omo-hyoid, open-

ing it with the point of the knife, and then slitting it open upwards and downwards. The muscular fibres of the omo-hyoid are now exposed and bare, and higher up the proper sheath of the vessels, more or less overlapped towards the mesial line by the lateral lobe of the thyroid body. This latter structure is drawn aside by a blunt hook. The sheath, now fully exposed, is opened carefully by raising a portion of it which lies immediately over the artery with a pair of dissecting forceps, and you will observe that I apply the edge of the knife horizontally, so as to cut out the portion raised without risk to the subjacent vessel. This manoeuvre results in a rounded opening or hole in the sheath. I clear the internal edge of this opening from the vessel, lay hold of it with a pair of artery forceps, so as to fix it, and give the forceps to an assistant to hold the edge gently, or simply

Fig. 138. Operation for ligature of common carotid.

let the forceps hang across the neck, and hold the margin aside by their own weight. I next seize the outer margin of the opening in the sheath with the dissecting forceps, and clear the vessel to a very small extent from its cellular connections, but thoroughly, so as to enable me to pass the armed aneurism needle round the vessel without any force. If I meet with any resistance I withdraw the needle and clear the vessel a little more. When I see the point of the needle on the inner side of the carotid, I do not, you will notice, depress the handle so as to elevate the point from the wound, as that raises the vessel too much from its sheath, and is apt to tear and destroy its vascular connections. I merely keep the needle firm, and with the dissecting forceps seize the ligature and hold it, whilst I withdraw the needle. The point of the aneurism needle should always be passed from the outer side of the vessel, so as to avoid risk of injury to the jugular vein. If care be taken to open the sheath directly over the artery, and to keep the point and surface of the needle close to the coats of the vessel in passing round it, there is no risk of including the vagus nerve or injuring the vein. In my own experience in tying the carotid in the living I have felt the vein in the sheath, but have never seen it bulge

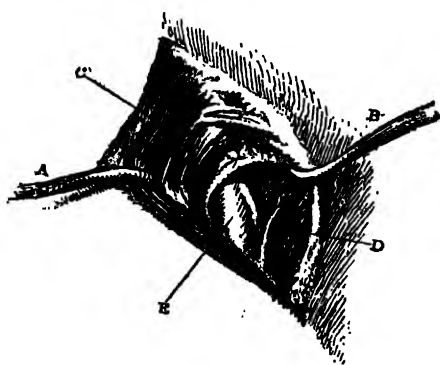


Fig. 139.

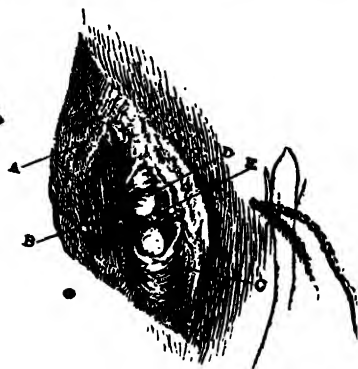


Fig. 140.

over the artery. If, however, the sheath be opened so as to expose the vein, it will be more likely to overlap the artery and give trouble to the operator.

The operation I have now demonstrated is that for ligature of the carotid above the omo-hyoid. When we require to tie the vessel lower down, we extend the incision downwards along the edge of the mastoid, and draw that muscle more fully aside than in the former

Fig. 139 shows the parts in ligature of carotid below the omo-hyoid nearly life-size. —After Sir CHARLES BELL. A, Blunt hook holding aside the sterno-mastoid. B, Another hook holding the edge of opening in the sheath. C, The omo-hyoid crossing the sheath above the opening. D, The sterno-thyroid muscle. E, The carotid artery exposed. As described in lecture I prefer the catch artery forceps to seize the margin of the opened sheath, as causing less disturbance of parts.

Fig. 140. Ligature of carotid above the omo-hyoid operation completed. A, Skin and platysma. B, Edge of sterno-mastoid. C, Sheath of artery. D, Common carotid tied. E, Ligature of dentist's silk has by means of needle been carried directly forward through the skin so as to permit primary union of the incision.

operation; and now you will observe I divide the fascia which covers the omo-hyoid, and separate the connections of that muscle with the sterno-hyoid and sterno-thyroid. The omo-hyoid is then drawn upwards, and the sterno-thyroid drawn inwards. The sheath is thus exposed, but much more deeply seated than in the higher operation. In the living subject, when the neck is short and the omo-hyoid broad, it forms a considerable obstacle to dealing with the sheath and clearing the vessel; and I have had occasion to divide a few of its fibres to gain room. Indeed, rather than tie the artery very low down, or have much difficulty or manipulation in the deep part of the dissection, I would strongly advise complete division of the anterior belly of the omo-hyoid, to expose the vessel easily and lessen the depth of the wound, and to render the operation less dangerous.

In one case, in which I required to tie the left common carotid very low down, in a man with a short muscular neck, I found great difficulty in drawing aside the inner margin of the sterno-mastoid, which stood out in strong relief and deepened the wound. This was before the days of chloroform; but still, were I now called on to operate so low down in the neck, I would make a small incision at a right angle with the cervical incision, so as to divide the skin and internal origin of the mastoid muscle, and reflect the flap thus formed, as in ligature of the innominate artery, so as to simplify the operative procedure.

M. Sedillot has proposed to reach the carotid artery by an incision between the sternal and clavicular attachments of the sterno-mastoid muscle. Such an incision, however, would correspond rather to the compartment of the sheath containing the jugular vein than the artery, and the operation in the living would be more difficult owing to the restricted space between the separated portions of the muscle; and I therefore consider the ordinary method, with the modifications I have indicated in certain circumstances, as the best to be followed.

When the operation is concluded, the head should be bent slightly forwards to relax the parts and prevent tension of the deligated vessel. To fix the head in this position a circle of bandage round the head is connected with slips of bandage fastened to a broad circular bandage round the chest, and the patient is placed in bed with the head and shoulders raised. An opiate should be given, and some anodyne linctus, such as some emulsion containing small doses of hydrocyanic acid, or other sedative, to prevent or allay laryngeal irritation. When, however, irritation has led to symptoms of pulmonary congestion, I have seen marked benefit follow venesection, with relief of the urgent symptoms.

The diet should at first be nutrient, but non-stimulant, such as white of egg with milk, and farinaceous diet. White fish, and fowl, or other animal food of a more stimulating nature, may be gradually given.

LECTURE LXV.

Ligature of the First, Middle, and Third Portions of the Subclavian Artery.

THE first or internal portion of the SUBCLAVIAN ARTERY extends from the origin of the vessel to the inner margin of the anterior scalenus muscle. On the left side this part of the vessel, as it ascends from the thorax, is so situated as to be scarcely in the cervical region, and is consequently beyond the reach of surgical operation.

On the right side, owing to the manner in which it arises from the innominate artery, this part of the subclavian is placed in the neck, but is most unfavourably situated for the application of the ligature, whether we regard its complicated relations to important structures or the numerous branches given off within so short a space. From its origin till it reaches the edge of the scalenus anticus, the first part of the right subclavian is not more than an inch and a half in length, and in this space it gives off the internal mammary and vertebral arteries, and thyroid axis. These large collateral branches form a very great disturbing force on the distal side of the ligature, and so prevent the hæmostatic process taking place; while, on the proximal side, we have the force of the cardiac circulation through the innominate and right carotid arteries. The relations of the first part of the subclavian artery are also much more complicated than those of the innominate artery. This part of the subclavian is crossed in front almost immediately after its origin by the vagus nerve, whilst the recurrent laryngeal branch of that nerve curves round it, so that both these important nerves are in close contact with the vessel. Upon it and the innominate artery also lie the cardiac branches of the vagus. Immediately external to the vagus the internal jugular vein crosses and covers the artery, whilst below, the vessel is in relation to the commencement of the right vena innominata. This part of the subclavian is also in close contact with the pleura, and with the great vertebral vein. The latter is very troublesome in the operation, and cannot well be drawn aside, from its being fixed.

In most cases of subclavian aneurism, where any artery has been tied, the innominate has been the vessel chosen, for the reasons before given; but when the first part of the subclavian is to be tied, nearly the same incisions are required as in the former operation:—one over the inner part of the clavicle, dividing both origins of the sterno-mastoid; and another along the anterior margin of the sterno-mastoid, taking care to avoid the external jugular vein, which lies along the

outer edge of the muscle. The artery is then exposed by careful dissection, and important structures held aside till the aneurism needle is passed below it and the ligature secured. It might be thought that the chief danger in the operation would be the sudden interruption of the supply of blood to the parts furnished by the subclavian; but the real danger consists in the tendency which the free and forcible circulation around the deligated point has to disturb the subsequent hæmodynamic process.

On reaching the anterior scalenus, the subclavian artery passes behind that muscle, and is directly covered by it until it emerges from behind its outer margin to gain the first rib, on the surface of which it continues to rest until, after passing from off the rib, it receives the name of axillary.

That portion which lies behind the scalenus is termed the middle portion of the subclavian, and is covered by the whole breadth of the anterior scalenus, and its course is crossed obliquely from above, downwards and inwards, by the phrenic nerve, which rests upon the scalenus. The subclavian vein lies lower down towards the chest, resting on the anterior and inner part of the costal attachment of the scalenus, whilst more superficially this part of the vessel corresponds to the clavicular attachment of the sterno-mastoid muscle, platysma, and skin. In this part of its course the subclavian gives off two branches, or more generally a short common trunk dividing into two branches—the ascending deep cervical, and the superior intercostal. This middle portion, then, is very deeply seated; its lower surface is in close relation to the pleura, whilst the phrenic nerve crosses its course in front. The third or outer part of the subclavian, commencing where the artery emerges from beneath the cover of the scalenus, is only covered by the skin, platysma, superficial, and deep fasciæ of the neck; but owing to the arch formed by the clavicle, the vessel still lies very deep. As this is the part of the subclavian which is most frequently the subject of surgical operation, we require to consider its relations very carefully.

The external third of the subclavian artery is situated in what is termed anatomically the inferior external or posterior triangle of the neck, a space bounded internally by the outer margin of the sterno-mastoid, inferiorly by the clavicle, whilst the posterior belly of the omo-hyoid, passing obliquely upwards and forwards, forms the superior and outer boundary of the space. Superficially, the area of this triangular space is covered in by the skin, superficial fascia, platysma, and deep fascia; whilst under the platysma we find the external jugular passing down to join the subclavian vein, and placed generally close to the outer edge of the sterno-mastoid, though not unfrequently it lies nearly over the middle of the space. Its position, however, can always be readily ascertained by pressure on the lower part of the neck, so as to make the vein distend. On dividing the deep fascia which binds down the omo-hyoid, we come upon a quantity of loose cellular tissue, containing numerous venous branches, such as the transversalis colli and others, running towards the subclavian vein. These venous branches generally coalesce to form a large trunk before joining the subclavian, and the large vein formed by their junction lies almost in front of, and in

close apposition to, the subclavian artery. We have now arrived at the deeper plane of the triangle, on a level with the artery and the parts in immediate relation with it. The subclavian artery may be described at this level as situated in a deeper triangle—the boundaries of which are, internally, the outer margin of the scalenus anticus; externally, the scalenus posticus, the convergence of the scaleni forming the apex of the triangle, whilst the base and inferior boundary is formed by the first rib, on which the vessel rests. Contained within the limits of this deep triangle we find, superiorly, the nerves forming the brachial plexus, and inferiorly the subclavian artery. Crossing the area of the space near its apex is the transversalis colli artery or its branches, the posterior scapular and ascending cervical; lower down, the vein already mentioned, lying in front of the subclavian artery, passing down to join the subclavian vein, which is situated lower down towards the chest, and barely resting on the tendon of the scalenus anticus, so as to leave a small space in which the costal attachment of the muscle is seen, between the vein and artery. The supra-scapular artery and vein lie in close relation to the posterior surface of the clavicle.

If we now consider the relation of parts in reference to guides to the third part of the subclavian, we find, first, that very generally the outer edge of the sterno-mastoid corresponds to the outer edge of the scalenus anticus, with sufficient accuracy to form a guide to the position of that muscle. Second, that the outer edge of the scalenus is in relation at its upper part with the nerves of the brachial plexus, and at its lower part with the subclavian artery which lies immediately behind it, close to its insertion into the first rib. Third, that this attachment of the scalenus anticus to the first rib is marked by a well-defined osseous prominence or tubercle.

If we pass the finger from above downwards along the outer margin of the scalenus muscle to its attachment, we are guided to the tubercle on the first rib, and when the point of the finger touches the tubercle the pulp of the finger must rest in contact with the subclavian artery, which lies in a shallow groove on the rib immediately behind and external to the tubercle. Thus we have a series of guides leading us from the surface to a fixed point in close relation to the artery, if it be in the normal position.

The position and relations of the middle and external portions of the subclavian arteries are remarkably constant, for although cases have been met with in which the artery ascended high in the neck, and then passed downwards, and much further back than usual, or others in which the vessel perforated the anterior scalenus, and although there are also instances of the vein as well as the artery lying posterior to the scalenus anticus, or of the artery passing in front of the scalenus anticus, so as to be in close contact with the vein, yet such irregularities are very rare. In my own experience as an anatomist, out of many hundred bodies dissected in the practical rooms, where any abnormal distributions of the bloodvessels were carefully watched for, I have only seen two instances of irregularity in the third portion of the subclavian, in both of which the artery passed in front of the scalenus, so as to be in apposition with the subclavian vein, and in both cases

the irregularity was on the right side. The third part of the subclavian is usually described as not giving off any branches; but I believe it is almost as common to find the posterior scapular artery coming off from the subclavian close to the outer edge of the scalenus, as to find it arising from a common trunk with the ascending cervical from the thyroid axis, which is generally stated to be its usual mode of origin.

The anastomoses to which we chiefly trust for restoring the circulation after deligation of the external third of the subclavian are—1st, The supra-scapular, with the dorsal branches of the subscapular artery in the substance of the supra- and infra spinatus and teres minor muscles. 2d, The posterior scapular artery, with branches from the subscapular along the inferior costa and base of the scapula, and in the substance

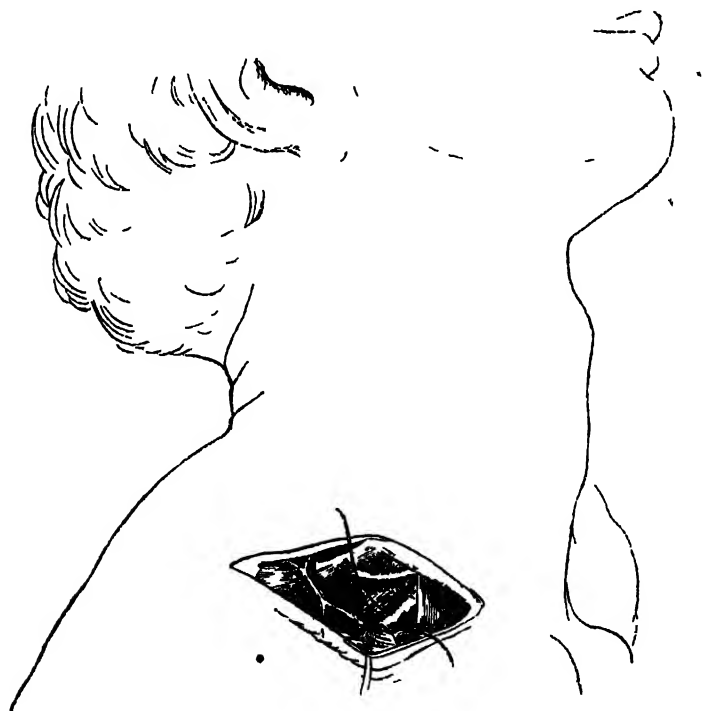


Fig 141

of the subscapular muscle. 3d, Minute perforating branches from the internal mammary and intercostal arteries, inosculating with thoracic branches of the acromio thoracic artery and other thoracic branches given off by the axillary. But, besides these more evident and direct anastomoses, the determination of blood on the collateral circulation which follows the obstruction of the subclavian artery brings into play vascular communications throughout all the surrounding tissues.

Fig. 141 Incision for ligature of third part of the subclavian artery. The outer part of sterno-mastoid has been partially divided to expose part of the scalenus anterior.

As ligature of the middle part of the subclavian has never been performed except as an extension of operations originally undertaken with the view of tying the external third, in which, owing to disease of that part of the vessel, it was found necessary to divide the scalenus to reach a healthy part of the artery, it is unnecessary to describe it as a special operation. But to consider the further procedure in such cases in connection with the operation for tying the third portion of the artery:—

The external third of the subclavian may be reached so as to apply a ligature, by means of a single incision parallel to and about eight lines above the clavicle, extending from the anterior margin of the trapezius muscle to a point a few lines internal to the outer margin of the sterno-mastoid. The more important parts of the operation will, however, be much facilitated by making another incision about an inch and a half in length along the outer edge of the sterno-mastoid, so as to join the former incision nearly at a right angle. This method enables us, by dissecting or merely drawing back the angular flap marked out at the internal part of the wound, to

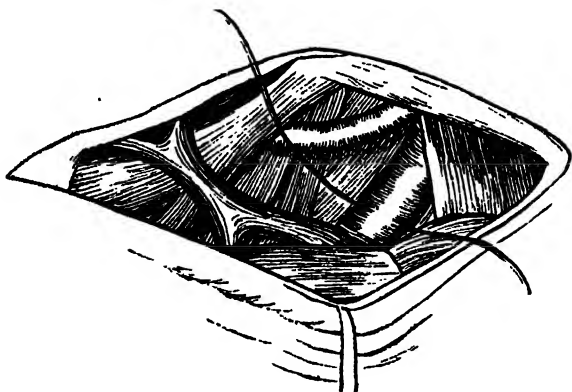


Fig. 142.

expose fully the parts immediately in relation to the vessels, so as to deal more readily with the artery, or to modify the operation, if necessary, by extending our incision inwards. There is no use in dissecting deeply at the outer part of the supra-clavicular incision as we gain no room by doing so, and it is liable to lead us away from the subclavian artery and endanger the suprascapular vessels. The skin, superficial fascia, and platysma myoides, should be divided by the first incision in the line indicated, care being taken to cut lightly through the textures over the course of the external jugular vein, so as to avoid wounding that vessel, which should be drawn aside, if necessary, by a blunt hook. The next step in the operation consists in dividing the deep fascia at the middle and inner part of the wound. In doing this there should be no dissection upwards or downwards; the fascia should

Fig. 142 exhibits the same incision; parts of life-size. See also description in text.

be divided in the line of the incision directly from the surface towards the deeply-seated parts. When this is effected the angular flap of the textures can be drawn upwards and backwards; not forcibly, but merely held aside. At this stage the posterior belly of the omo-hyoid generally comes into view, and has by some been recommended as a guide; but it is not a safe guide to the artery, since it merely marks the depth or plane at which we have arrived. When the deep fascia is divided, the operator should pass his finger close to the outer edge of the sterno-mastoid muscle, directly backwards, to try if he can feel the outer margin of the anterior scalenus, or perhaps touch the artery itself. In general, however, the outline of the scalenus and the position of the vessel are rendered indistinct by a quantity of areolar tissue and lymphatic glands being interposed, and the operator requires to break through this layer with his finger, or by the cautious use of the point of the knife, to clear the scalenus more fully; he then glides the fore-finger of his left hand from above downwards along the outer margin of the scalenus anticus, till the point of his finger touches the tubercle on the first rib, into which the muscle is inserted; immediately above and behind this the subclavian is felt. By attending to this rule the operator will avoid the risk of mistaking the large nerve which passes from under the edge of the scalenus immediately above the subclavian for that vessel. The next and most important step is to clear the vessel for passing the armed aneurism needle. In doing this we must keep in view the position of the venous branches crossing the course of the artery in front to join the subclavian vein, whilst higher up and deeper the pleura is in close relation to the deep surface of the vessel, and may be wounded in passing the needle. The former of these dangers is best avoided by the mode of incision I have recommended, which enables the operator to see the deep part of the wound, and, by using the point of the finger and nail, gently to separate any loose tissue and push aside the veins before using the point of the knife, to clear the artery for ligature. The second danger—wound of the pleura—is best avoided by passing the needle under that part of the subclavian which rests upon the first rib, not higher up; and this rule is also advantageous, should the posterior scapular artery arise, as it often does, from the third part of the subclavian close to the edge of the scalenus. The aneurism needle for this operation should be short in the point, and have a double curve to play over the clavicle, so as to allow the point to appear round the artery without elevating the vessel and unduly separating its connections. In accordance with the general rule, the point of the needle should be passed from the position of the subclavian vein upwards and outwards; but in many cases it is difficult to effect this, owing to elevation of the shoulder raising the clavicle so as greatly to deepen the subclavian space. In such cases the point of the finger may be made to guard the vein whilst the needle is passed from above downwards.

Should the third portion of the subclavian be found in a doubtful condition for the safe application of a ligature, the incisions must be extended so as to expose the middle portion. For this purpose the incision is carried through the clavicular attachment of the sterno-mas-

toid and the superimposed tissues. This procedure, added to the former incisions, exposes the scalenus anticus, with the phrenic nerve crossing it obliquely from above downwards and inwards, and lower down, and more internally, the confluence of the subclavian and internal jugular veins. Two important arterial branches, the transversalis colli and supra-scapular, cross the scalenus more superficially than the parts mentioned, and require to be avoided in dissecting through the cellular tissue lying between the sterno-mastoid and the more deeply-seated parts. Even in tying the third portion of the subclavian I have seen one of these vessels wounded, and give rise to serious embarrassment to the surgeon and danger to the patient. And we must also remember that these are two of the most direct and important anastomosing branches for re-establishing the circulation in the upper extremity after deligation of the subclavian. The special points of danger, however, in this extension of our incision to expose the part of the artery covered by the scalenus, is the risk of injuring the phrenic nerve lying upon the muscle to be divided, and injury of the pleura, which is here in close proximity to the vessel to be tied. The former danger is met by drawing the nerve gently aside by means of a narrow copper spatula, and then carefully dividing the scalenus, so as to expose the subclavian whilst the wound of the pleura is guarded against by keeping the point and concave surface of the aneurism needle in close contact with the coats of the artery in passing round it.

When all oozing of venous blood has ceased, the wound is closed by points of suture, and the patient placed in bed, with the arm supported but not much bent. The patient should be laid upon the side operated on, so that serous discharge or venous oozing, if there be any, may escape by the outer angle of the wound. One of the secondary risks of ligature of the subclavian, apart from the risk of secondary hæmorrhage, is the formation of pus at the deep part of the wound from the accumulation of discharges which have lodged there, and as there is great difficulty in placing the patient so as to obtain a dependent aperture of escape, the pus is apt to burrow towards the pleura, and even ulcerate into the pleural cavity. To obviate this risk as well as that of secondary hæmorrhage, there should be the least possible disturbance or fingering of parts during the operation; all oozing of blood, however slight, should be arrested by cold, or some other plan, before the wound is closed, and attention given that no accumulation be allowed to take place.

LECTURE LXVI.

Ligature of the Axillary Artery in First, Second, and Third Portions—Ligature of the Brachial Artery—Ligature of the Radial Artery at Superior and Inferior Parts—Ligature of the Ulnar Artery.

LIGATURE OF THE AXILLARY ARTERY used to be performed for axillary aneurism, but the operation has now been given up. I should only perform it in Brasdor's operation for tying the artery on the distal side of the aneurism, in the case of subclavian aneurism, or as a preliminary to amputation of the arm for that disease. I should be inclined to tie the upper part of the axillary, under these circumstances, to prevent bleeding from the enlarged muscular branches, and also because it would avoid having a great number of collateral branches coming off between the aneurism and the ligature. The operation is a much more difficult one than tying the third part of the subclavian artery. Some authorities recommend cutting down between the two portions of the pectoral muscle, and cutting through the coraco-clavicular fascia, but in doing this we come upon the vein and not the artery; and secondly, we have a very constricted and narrow opening with a very deep wound. Others, again, advise to cut between the clavicular fibres of the deltoid and the clavicular fibres of the pectoralis major, but this is also objectionable. The best plan is to cut across the fibres of the pectoralis major and some fibres of the deltoid, so as fully to expose the deeper parts, and then through the coraco-clavicular fascia. Care must be taken not to wound the axillary vein, which is superficial and internal to the artery. The axillary nerves lie to the outside of the artery, and are not much in the way. This operation, however, merely enables us to get at the vessel just at its commencement, and nearly the same point can be reached much more readily by the operation for ligature of the third part of the subclavian, without approaching so nearly the origin of the large acromio-thoracic branch, and hence ligature of the subclavian is preferable in cases of axillary aneurism.

The middle or second portion of the axillary artery is never tied in cases of aneurism, except when the old or direct operation is performed, as described at page 353, owing to the number of collateral branches coming off from it. When wounded it may require ligature, which must be effected by enlarging the external wound.

The third portion of the axillary artery may be tied quite as easily as the brachial artery. In this case, our best guide is the inner edge of the coraco-brachialis muscle. If we trust to the feeling of pulsation

in the artery as our guide to its position, we are very apt to be misled. After dividing the skin and fascia, the first thing we should look for is the margin or edge of the coraco-brachialis. Immediately internal to it the median and internal cutaneous nerves come into view, and behind and between them is the artery. The nerves are separated slightly, the arm being relaxed, and the needle is then easily passed round the artery.¹

The BRACHIAL ARTERY may require to be tied in cases of circumscribed false aneurism, or circumscribed varicose aneurism: and it has in such cases been tied in the middle of the arm with success; but still I think the best plan of treating a false aneurism is to cut into it, and tie the vessel above and below, so as to prevent all retrograde circulation. The cases in which the brachial artery requires to be tied are those in which either the brachial itself or the palmar arch has been wounded. In the latter case, the general principle of securing the vessel at the wounded point in the first instance should be followed out; but if hæmorrhage result after doing this, and if the parts be in such a state that we cannot apply pressure directly on them, then we must tie either the radial and ulnar arteries, or the brachial, and apply some moderate compression on the wounded point. In wounds of the palmar arch we should enlarge the opening in the skin and fascia at first, and apply direct compression on the arch, with a bandage and pad of lint along the course of the brachial, so as to command the circulation. In most cases these means will succeed; but when they prove inefficient, or when the coats of the artery slough, then we must tie the brachial in the middle of the arm, which is safer than tying both radial and ulnar arteries, from the free anastomoses of these vessels, and we must also apply a moderate amount of compression on the wounded point.

Operation.—The brachial artery is very easily reached, and can generally be felt in the living subject; but we should not trust to the feeling of pulsation only, as we are apt to be misled. The best guide to the position of the artery is the inner margin of the biceps, the arm being extended. The median nerve passes obliquely from without inwards and downwards, crossing the vessels, so that it lies upon the artery about the middle of the arm. It must be gently drawn aside, the vessel cleared from the venæ comites, and the needle then passed below the artery. When we cut down on the artery at the middle of the arm, if we find a large vessel, without seeing the nerve, it is probable that the artery has divided into its two terminal branches, higher up than usual, and the other branch should be looked for in its normal relation to the median nerve.

The brachial artery may require to be tied at the bend of the elbow in cases of false aneurism. A tourniquet is applied at the upper part of the arm, so as to prevent all bleeding; and an incision is made into the sac of the aneurism, and its contents turned out, and the vessel tied above and below the wounded point—as already described at page 541.

¹ See Clinical Cases, page 563.

The **ARTERIES OF THE FOREARM** seldom require to be tied except for the immediate or secondary effects of wounds. In such cases the wound should always form part of our incision, as, otherwise, the wounded part of the vessel may not be reached except by unnecessary dissection. But whilst this will modify the procedure for ligature of the vessels in different cases, I think it right to indicate some general rules for the performance of ligature of the radial and ulnar arteries.

To perform the ligature of the **RADIAL ARTERY** above the middle of the forearm, the limb being extended and resting upon its dorsal surface, the surgeon standing to the outside makes an incision at least two inches in length, and parallel with the internal edge of the supinator radii longus muscle. In order to find the edge of that muscle it is sufficient to apply the fingers of the right hand upon the radial artery, as if to feel the pulse, and trace it towards the bend of the arm by following the furrow, which is bounded externally by the supinator radii longus, and internally by the muscular mass formed by pronator radii teres, flexor carpi radialis, and palmaris longus muscles.

In this manner the intermuscular space which lodges the vessel is easily found. If the incision, however, is not made perfectly to correspond with this line, it will not be of much consequence; to remedy this fault it is sufficient to divide a few muscular fibres to arrive at the artery, which is always found in the first intermuscular space we arrive at in tracing from the external to the internal side of the forearm. The mobility of the skin upon the aponeurosis renders the examination of this space very easy. The skin alone having been cut, the surgeon searches, as we have said above, for the internal edge of the supinator radii longus muscle, and dividing the aponeurosis parallel with that muscle, and slightly raising it, perceives the vessel placed immediately below. But before proceeding to insulate, in order to tie the artery, he must open the posterior layer of the aponeurotic sheath of the supinator radii longus muscle. This layer divided, the operation is easily terminated.

At the inferior part of the forearm the muscles which we have seen to surround, by their fleshy bodies, the upper portion of the radial artery, being only represented by their respective tendons, a large space is left between them, so that nothing can be easier than the ligature of the artery in this region. This artery is accompanied, as in its superior parts, by two veins, one internal and the other external to it, and covered by the aponeurosis and the skin.

To perform this operation, an incision corresponding with the middle of the space which separates the tendons of the supinator radii longus and the flexor carpi radialis muscles, must be made to divide the skin, and the aponeurosis must be divided to the same extent as the skin. This done, the artery, with its accompanying veins, is seen; the insulation must be carefully effected, so as not to wound the veins, and the ligature applied. It may be mentioned, however, that the rupture of a single vein, or its ligature, if it be small, does not occasion any real danger.

In order to tie the **ULNAR ARTERY** at its upper part, the forearm must be extended and laid upon its dorsal surface. The surgeon,

standing either to the inner or outer side of the limb, searches for the tendon of the flexor carpi ulnaris, which is readily known at its inferior part by feeling for the pisiform bone to which it is attached. This done, he must trace from below upward the furrow which separates the tendon from that of the flexor digitorum sublimis, and thus proceeding towards the internal condyle of the humerus, the direction is indicated in which the incision must be made. The surgeon, after having determined the edge of the flexor carpi ulnaris, makes an incision through the skin with the bistoury, parallel to that edge: he then searches for the first intermuscular space which can be found proceeding from the ulnar to the radial side of the arm. If the skin be very movable, this is easily distinguished, so that, if the first incision be badly directed, it can be corrected by means of the mobility of the skin. We could not, however, avail ourselves of this resource had the skin, aponeurosis, and a certain portion of the muscular fibre, been cut at the same time.

Having found the intermuscular line which is formed by the contact of the flexor carpi ulnaris, and of the flexor digitorum sublimis, the aponeurosis which unites them must be divided, and those muscles forcibly separated from each other. In order to facilitate the opening of the wound it is recommended that the hand be slightly flexed upon the forearm, and the forearm upon the arm. In following the external surface of the flexor carpi ulnaris from within outward, we see upon the same plane first the ulnar nerve, the internal vein, and then the artery with the other vein to its outside. At the superior angle of the wound the nerve is separated from these vessels by a space which diminishes towards the inferior angle, until they come into immediate contact. The vessels having been exposed, the artery must be insulated and tied.

Ligature of the ulnar artery at the inferior part of the forearm becomes much easier. The two muscles, which, being in apposition superiorly, cover the artery and its accompanying veins, are in this region separated from each other for the space of five or six lines, so that it is extremely easy to arrive at the artery. To accomplish this, an incision through the skin must be made parallel to the tendon of the flexor carpi ulnaris, but two or three lines external to it; the position of the pisiform bone, into which it is inserted, forms a sure guide to the tendon. Having divided the skin, the last-named tendon must be found, and the aponeurosis divided to the same extent as the incision in the skin. The opening having been made, the tendon of the flexor carpi ulnaris, the nerve, and then the vessels, are exposed to view; the artery is placed between its two veins, it is easily insulated, and its ligature accomplished.

LECTURE LXVII.

**Surgical Anatomy of the Iliac Arteries—Steps of the Operation for tying them—
Modes in which the Circulation is subsequently re-established—Direct Ligature
of the Iliac Arteries for Aneurism.**

THE abdominal aorta, on reaching the lower part of the lumbar vertebræ, divides into its terminal branches, the two common iliac arteries, and its more direct continuation, the small artery known as the middle sacral. Its two great lateral branches, the common iliac arteries, descend obliquely outwards and somewhat forwards, diverging until they arrive in front of the sacro-iliac synchondrosis, at which point each common iliac again subdivides into the internal iliac or hypogastric artery and the external iliac.

The internal iliac artery passes abruptly downwards from the point of division in front of the sacro-iliac synchondrosis, and, on arriving at the level of the ischiatic notch, subdivides into numerous branches to the various pelvic viscera and others which pass through the obturator foramen and ischiatic notch to be distributed outside the pelvis. The external iliac artery, from its place of origin, passes downwards and slightly outwards until it reaches a point nearly midway between the anterior superior spine of the ilium and the symphysis pubis corresponding to the ilio-pectineal eminence; it then passes beneath Poupart's ligament, and receives the name of common femoral. The relations of the arteries whose general course I have indicated may be stated as follows:—Each common iliac is about $2\frac{1}{2}$ inches long, and in its descent rests on the lateral aspect of the bodies of the inferior lumbar vertebræ, and is somewhat in relation laterally to the inner part of the psoas musculo, to which it approaches more closely at its bifurcation. On the right side the common iliac trunk rests, in its lower half, upon the junction of the right and left common iliac veins, where they are about to form the inferior vena cava; or, more properly speaking, rests on the commencement of the cava. On the left side the common iliac vein lies completely internal to the corresponding artery.

In front these vessels are covered by a layer of the peritoneum, very loosely connected with them, and easily pushed aside. Still more in front we have the abdominal viscera and inferior mesenteric artery, and the anterior abdominal parietes, which have a variable relation to the vessels in regard to distance, according to the development or distension of the abdomen and the state of the viscera. The ureter occasion-

ally crosses the common iliac trunk; more generally, however, this duct crosses obliquely immediately below the bifurcation, or just at that point. In either case the ureter is very loosely connected with the parts over which it passes, and when the peritoneum is pushed inwards from off the surface of the vessels the duct follows the peritoneum. The internal iliac artery in its course rests posteriorly on the nerve connecting the lumbar and sacral plexus, and on the nerves forming the latter plexus as they pass outward. The corresponding veins lie to the inner side of the artery, towards the upper part, where the surgeon should apply his ligature, for the internal iliac trunk is very short and variable in its length. The numerous veins which coalesce to form the internal vein have also very variable relations, some passing behind and some crossing it in front, and require to be carefully avoided in clearing the artery for ligature. The ureter lies in front, attached to the posterior surface of the layer of peritoneum which passes from the lumbar region and iliac fossa, and covers the fore part of the internal iliac artery.

The external iliac artery rests throughout its whole course upon the inner aspect of the psoas muscle, and more immediately upon the aponeurotic fascia, covering the muscles of the iliac fossa. The connective tissue here is very fine and loose, so that the vessel is easily separated from its posterior connections. The external iliac vein lies in close contact with the internal side of the artery, and in front a branch of the genito-crural nerve lies upon it; further removed, and gradually passing towards the parietes, the spermatic artery and veins also pass down in front. In some cases lymphatic glands lie in close relation to the vein, at the lower part. The fold of peritoneum reflected from the anterior abdominal parietes upon the iliac fossa covers the fore part of the vessels, but at a short distance above Poupart's ligament, corresponding to the point of reflection, the peritoneum may be said to be separated by an interval from the artery and vein; and throughout the whole of the iliac fossa, and immediately above Poupart's ligament the peritoneum is so loosely connected as to be easily separable from the vessels; whilst higher up, in the lateral region of the anterior abdominal parietes, the membrane is very closely connected with the fascia transversalis, and attempts to separate it from the parietes there would almost certainly be attended with laceration or puncture. On arriving close to Poupart's ligament, the external iliac gives off two branches, the deep epigastric and circumflex ilii arteries. The former courses obliquely upwards and inwards, the latter outwards, in the direction of the spine of the ilium. The vas deferens, as it passes from without inwards, crosses the course of the external iliac vessels, more especially that of the vein, and, together with spermatic vessels forming the spermatic cord, lies in pretty close relation to the anterior aspect of the vessels near the lowest part of their course. Lastly, in front we have the intestines projecting into the peritoneal sac, and the anterior abdominal parietes, as in the case of the other iliac arteries. In speaking of the general course of the external iliac artery, I have described its normal position on the anterior and inner aspect of the psoas throughout its whole length; but in old persons, or in cases in-

which an aneurism or other cause of obstruction to its circulation is present, the artery, owing to the feeble cellular connections which it has with the fascia on which it rests, forms numerous flexures, or one or two large curves, so that a large part of the vessel often dips into the true pelvis before it ascends again to gain the pubis. This need give rise to little or no difficulty in operating for ligature of the vessel, because, at its lower part it is always found on the pubis ; so that, by tracing it from that point upwards, or from its bifurcation downwards, its position in any case can be readily ascertained. But it is well to recollect how easily it is displaced, in relation to diagnosis of iliac aneurism, and in deciding whether the external or common iliac artery should be tied ; for in some cases of aneurism, low down on the external iliac, the tumour displaces the upper part of the artery, curving it on itself, and thus might mislead us as to the extent of healthy artery between the aneurism and the common iliac.¹

Operation.—From the anatomical disposition of the parts, as described, it results that to expose and tie any of the iliac arteries, the skin, superficial fascia, the aponeurosis of the external oblique, and the internal oblique and transversalis muscles, together with the transversalis fascia, must be divided, whilst the peritoneum must be carefully separated from the iliac fossa, and pushed aside.

In performing the operation, the patient should be laid upon his back, the pelvis a little inclined towards the healthy side, so that the floating intestines may fall into the pelvis and cause less projection of the peritoneum into the wound. The operator, having ascertained the position of the spine of the pubis, commences his incision about two inches external to that point, and about eight lines above the crural arch, and carries it obliquely upwards through the skin and superficial fascia for about three or four inches, so that it shall terminate above, about ten lines internal to the anterior superior spinous process. It is evident that by this line of incision we cannot come directly upon the artery, but then we weaken the abdominal parietes less than by any other line of incision, and we reach a part where we can most readily push aside the peritoneum without risk. Any branches of arteries or veins which bleed should be tied, and then the aponeurosis of the external oblique muscle divided to the same extent as the incision of the integuments. The fibres of the internal oblique and transversalis muscles are next carefully divided, to the extent of two inches, at the lower outer part of the wound. The fascia transversalis is thus exposed, and must be divided with great caution lest we wound the peritoneum. Perhaps the best method of doing this is to raise a small portion in the dissecting forceps, and apply the edge of the knife, held horizontally, so as to cut out a small portion. This enables the surgeon gently to separate the edges of the opening in the fascia, and enlarge the opening with a probe-pointed bistoury, the edge of the bistoury being directed outwards. By the small opening thus made, the operator enters his forefinger and carefully separates the peritoneum from the transversalis fascia and muscles in the line of his incision, and then splits up the internal oblique and transversalis muscles to such an

¹ See Clinical Cases ; case of Mr. C. H.

extent as may be necessary to enable him to reach the vessel. He next pushes the peritoneum aside and inwards from the iliac fossa so as to expose the artery. An assistant, whose hands have been previously dipped in warm water, holds aside the sac of the peritoneum and contained viscera, so as to keep them out of the way of the operator, but this must be done with great care. If necessary, the outer margin of the wound may be held aside by a curved metallic spatula, but in general the vessels are readily seen. The fine cellular sheath should be opened over the fore part of the artery, and the circumference of the vessel cleared, so far as is required to pass the armed aneurism needle. The point of the needle should be passed from within outwards, so as to avoid injuring the vein. When the point appears at the outer side of the artery, the ligature is seized with the dissecting forceps, the aneurism needle withdrawn, and the vessel tied. Before closing the wound all clots should be removed, and any bleeding points secured.



Fig. 143.

In closing the incision, the sutures should be placed deeply, to prevent the risk of protrusion, and to obtain union of the deep as well as of the superficial parts of the incision, and thus obviate weakness of the abdominal parietes. In passing the sutures with this view, care must of course be taken to avoid puncture of the peritoneum with the needle. When the operation is completed, a large flat compress of lint is placed over the wound, and kept in position by broad strips of adhesive plaster, so as to support the abdominal wall in the vicinity of the incision. When removed to bed, the patient should be placed on the sound side, to remove, as far as possible, all pressure from the weakened part, and an opiate given to procure rest and diminish the peristaltic movements of the intestines.

The operative procedure for reaching either the internal or common iliac arteries, is, up to a certain point, precisely similar to that just described; but when the surgeon has to some extent separated the peritoneum from the iliac fossa, he continues to separate it further up from the interior of the transversalis muscle and fascia, pushing it gently inwards, and then, with a probe-pointed bistoury introduced flat on his finger, he turns the edge upwards and extends the incision to the degree required to enable him to reach the vessel which he wishes to tie. He must, however, remember that the closer attachment of the parietal peritoneum, and the greater bulging of that membrane

Fig. 143. Operation for ligature of external iliac as described in text.

high up in the abdomen, render it more liable to injury, and he must also keep in mind his proximity to the ureter and spermatic vessels.

The method of tying the external iliac by a nearly transverse incision, about six or eight lines above Poupart's ligament, as practised by Sir Astley Cooper, enables the surgeon to reach the vessel easily enough at its lower part, in the case of a femoral aneurism which does not bulge upwards. But the vessel is exposed too near its collateral branches, the epigastric and circumflex ilii, and the spermatic cord is in greater danger. The principal objection, however, is, that we cannot tie the vessel higher up, should that be found necessary, without having recourse to a new line of incision, such as that which I have described, so that the oblique ascending incision—Abornethy's method, as it is sometimes termed—is that generally, and I think deservedly, preferred.

The arterial anastomoses which maintain and ultimately re-establish the circulation beyond the point of deligation in the case of ligature of the external iliac artery, are very numerous, for, as I have already shown, every minute twig enlarges at first. But the larger and more direct inosculation, are—1. The internal mammary from above, with the deep epigastric from below, the deligated part. 2. The ilio-lumbar and the lumbar branches of the aorta, with the deep circumflex ilii of the external iliac. 3. The extra-pelvic branches of the internal iliac, with branches of the femoral—as, the scrotal branches of the deep pudic, with those of the superficial or inguino-pudic branch of the common femoral, and the gluteal ischiatic and obturator, with the branches of the internal and external circumflex and perforating arteries from the deep femoral.

When the common or internal iliac arteries have been tied, the free communications between the branches of the two internal iliacs, and of both with the middle sacral, together with the anastomoses just mentioned, speedily re-establish the circulation below the ligature, and the maintenance of the distal circulation is amply provided for.

When speaking of inguinal aneurisms, I referred to the revival of the old operation for aneurism, by opening the sac, turning out the contents, and then tying the vessel on either side of the sac. It is scarcely possible to lay down rules for the steps of such operations. The plan hitherto adopted has been to command the circulation through the abdominal aorta, by means of the abdominal tourniquet, and then to make a limited incision through the anterior parietes into the sac, to enable the operator to introduce his forefinger and break up the adherent coagula; then rapidly to enlarge this opening upwards and downwards, and turn out the coagula, and so expose the interior of the sac, and recognise the opening of the artery into it above and below, and clear the vessel and tie it at these points.

From what I have seen of such operations, it always appeared to me that very great difficulty occurred in recognising the orifices of the artery in the sac, and this is what we might expect from the way in which true aneurism, either sacular or fusiform, arises. Again, as I have pointed out when speaking of the loose connections of the external iliac artery, an aneurism of the lower part of that vessel, by enlarging, may push up or aside the upper part of the vessel, and lead the

surgeon to suppose it necessary to tie the common iliac. I should, if performing such an operation, make my incisions through the abdominal parietes where these were not adherent to the sac, by dividing them upwards and outwards towards the ilium and flank. Then, passing the finger gently downwards between the sac and the parietes, as far as that could be done without force, I should divide the abdominal wall in that direction. The peritoneum in such cases is usually pushed upwards and inwards by the tumour, and is so far removed from injury. Having enlarged the opening of the abdominal wall as far as could be done without injury to the sac, I should then feel with my finger for the artery higher up, so that an assistant might command it by direct compression, or I should clear it as closely down to the sac as possible, and place a ligature under it, and entrust it to the assistant. Then, returning to the lower part of the incision, I should by careful dissection divide the crural arch and fascia lata in the groin below the tumour, to command the circulation from below, and if possible trace and expose the artery close up to the sac, and let an assistant compress it directly. All being thus prepared, I should make a small incision into the sac, break up the coagula, enlarge the opening, and turn them out. The circulation being commanded both above and below the aneurism, I should then tie the upper ligature which had been placed under the vessel, and entrusted to an assistant at the earlier stage of the operation. If the lower portion of the artery admitted of ligature above the origin of the epigastric and circumflex ilii, I should tie it there, but if not, then, after tying these branches, I should clear the common femoral where it had been exposed, pass a ligature below, and tie it. Any coagula which remain or portions of the sac which can be removed without risk to the peritoneum, should be cut away, so as to diminish the risk of extensive suppuration, and the wound then closed.

LECTURE LXVIII.

Ligature of the Femoral Artery : in Lower Part of Scarpa's Triangle ; in Hunter's Canal—Anastomoses by which the Circulation is restored—Ligature of the Anterior Tibial Artery : of the Posterior Tibial Artery.

FROM the point where the external iliac artery emerges from below Poupart's ligament into the region of the thigh, until it enters the popliteal space, by passing through the opening in the tendon of the adductor magnus, the vessel receives the name of femoral. The general course of the FEMORAL ARTERY, if we include the commencement of the popliteal, is indicated by a prolonged and gently spiral line, which, in relation to the femur, descends from without inwards and backwards, then more directly downwards, and lastly, outwards and backwards, winding round so as to gain the posterior aspect of the femur in the popliteal space. The common femoral artery, the direct continuation of the external iliac, is always a very short trunk, not exceeding an inch and a half in length ; and, after passing from off the pubis, descends superficially, being merely covered by the integuments, superficial fascia, and the iliac portion of the fascia lata, and a variable quantity of fat and lymphatic glands lying on the fascia over the vessel. In this part of its course the vessel rests upon the lower part of the psoas, having the mass of the iliacus muscle, which is here united with the psoas, in relation to its outer side. The anterior crural nerve is in this region deeply seated between the iliacus and psoas muscles, but soon becomes superficial, and lies about a quarter of an inch, or rather more, to the outer side of the artery. The common femoral vein lies close to the inner side of the artery, and rests on the pectineus, a quantity of cellular tissue intervening. The common femoral gives off superficial branches—the superficial epigastric, superficial circumflex ilii, and superficial pudic. It then sends off the great profunda or deep femoral, which gives off numerous branches to the muscles and other textures of the thigh. The femoral artery continues to descend in the course already described till it reaches the popliteal space. As the femoral artery descends in the thigh, it gradually passes more deeply, and its relations become more complicated ; the vein, which above lies to its inner side, gradually comes to be placed behind it, so that the artery rests upon the vein. Both these vessels, together with the great saphenous branch from the anterior crural nerve, are inclosed in a common sheath, which lies in a canal bounded internally by the adductors, and externally by the vastus internus, where these muscles converge near their attachments to the femur. A layer of dense fascia, stretch-

ing from the vastus to the adductor muscles, passes in front of the vessels and closes the canal anteriorly. This fascia becomes aponeurotic towards the middle and lower parts of the thigh, and the canal, for two or three inches above the point where the vessels pass out of it into the popliteal space, is very narrow and contracted. In the middle and lower third of Scarpa's triangle, the femoral continues to be covered only by the skin and fasciæ; but gradually the sartorius muscle, which descends obliquely inwards from the superior spine of the ilium, comes into relation with the vessel, lying at first close to its outer side, on a plane superficial to it; next, slightly overlapping; and at last lying upon and covering the artery throughout the remainder of its course in the femoral region. The point of election for tying the femoral is at the apex of Scarpa's triangle, just where the sartorius begins to overlap the vessels, and hence the inner edge of this muscle forms our guide to reach the artery at this point; whilst, if we require to tie it lower down in Hunter's canal, the outer edge of the sartorius again serves as our guide to secure it. Under the fascia, beneath the sartorius, and in front of the sheath, there are sometimes a quantity of fat, and some nervous filaments from the anterior crural, which cross the vessels obliquely. From the point where the femoral artery gives off the profunda, with the exception of a few muscular branches no large collateral branch arises from it, until, at its lowest part; just before it passes through the adductor into the popliteal space it gives origin to the *anastomotica magna*.

Operation.—I have already said that the point of election for tying the femoral artery is towards the lower part of Scarpa's triangle, immediately above its apex, where the sartorius and adductor longus muscles approach each other. Here the sheath of the vessels is comparatively superficial, and the relative position of the sartorius gives

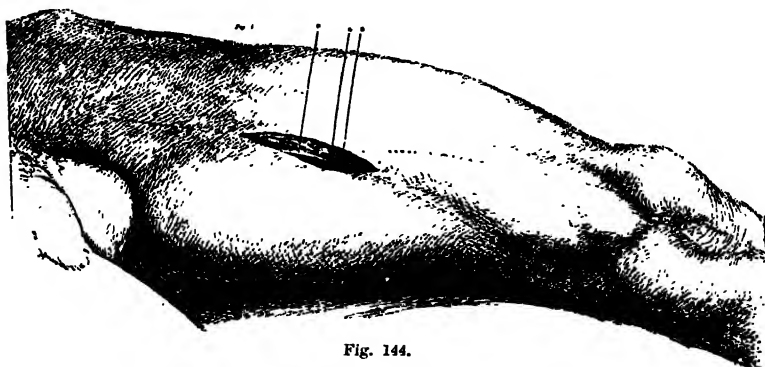


Fig. 144.

us an excellent guide to the artery. The surgeon having ascertained the course of the sartorius, and also the position of the saphena vein and the superficial veins which sometimes join that vessel in this region, should make an incision about three inches long, beginning two inches below the apex of Scarpa's triangle, and continuing it upwards to the requisite extent along the course of the artery. This

Fig. 144. Incision for ligature of femoral at the apex of Scarpa's triangle.

line of incision will correspond at its lower part to the inner margin of the sartorius. Higher up the muscle lies more obliquely outwards, less in relation with the artery. In operating on the right limb, the surgeon cuts from above downwards in the same line and to the same extent. This first incision should merely pass through the skin, superficial fascia, and fat, so as to expose the fascia lata, shining through which the sartorius muscle is generally seen. The fascia is next carefully divided along the inner edge of the sartorius, at the lower part of the wound, and slit up in the direction and to the full extent of the superficial wound. This exposes the fibres of the sartorius and the fascia covering the sheath of the vessels, under which there is often a quantity of fat. The operator should now trace from above downwards with his finger, so as to feel the pulsation, and so re-assure himself of the exact position of the artery. Without any further dissection, the edge of the sartorius is gently held aside at the part where it begins to overlap the sheath. The fascia is opened immediately over the artery by pinching up a portion of it with the dissecting forceps, and applying the edge of the knife horizontally so as to cut out a small piece. The opening so made is enlarged to the extent of an inch and a half or two inches. When this is done the

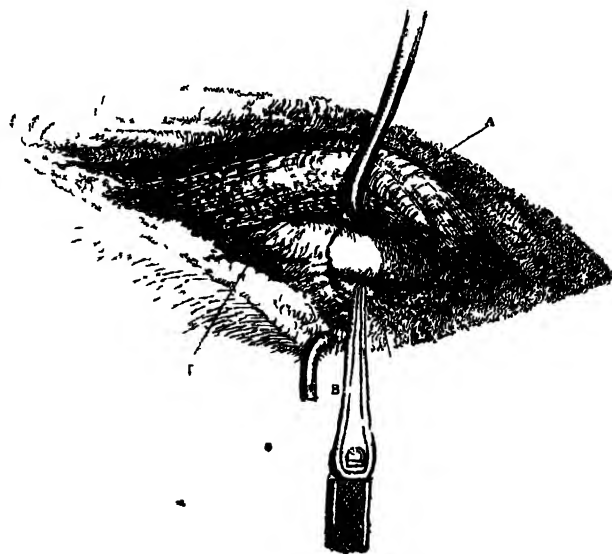


Fig 145

inexperienced operator might think that all he had to do was to pass the ligature, for the vessel comes into view full and rounded. But the most important steps of the operation yet remain to be performed—namely, opening the proper sheath of the vessels, and insulating the artery, for passing the ligature round it. The surgeon should raise it

Fig 145 represents the incision for ligature of femoral artery in Scarpa's triangle. The sartorius is gently held aside by a blunt hook (A) so as to expose the sheath of the vessel (B). B, the catch artery forceps fixing the margin of the opening in the sheath.

portion of the sheath, and open it in the same manner as he opened the fascia; and when he has, with the point of his knife, sufficiently cleared the sheath from the artery on its inner aspect, he seizes the margin so cleared with a pair of catch-artery forceps, and lets them rest on the inside of the limb, so as to fix the opening in the sheath (fig. 144). Then, laying hold of the external edge of the opening in the sheath with the dissecting forceps, he clears the artery from it in the same way and to the same extent as on its inner aspect, so that the armed aneurism needle may be passed without any force or undue disturbance of parts. Perhaps there is no artery in the deligation of which greater care is requisite in opening the sheath and clearing the artery than the femoral. The vein lies completely behind the artery at the point where it is usually tied, always closely, often firmly, connected to it, much more so than is the case in other vessels; and if the artery be not properly insulated, any attempt to force the needle between the artery and vein is almost certain to wound the latter.

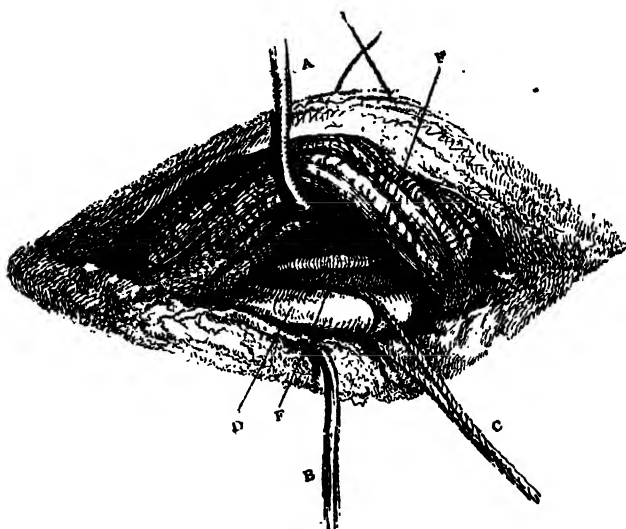


Fig. 146.

The artery should be fairly cleared for about two lines round its circumference, so as to allow the needle to be passed easily. The opening of the sheath in front is of course larger, a quarter of an inch or so, to enable the surgeon to see the parts. The aneurism needle is generally directed to be passed from within outwards; but as the vein lies quite behind, it is immaterial from which side we pass it, if we only attend to the clearing of the artery already spoken of. Should the needle, by any accident, puncture the vein, it should be at once withdrawn and passed more carefully. If the thread be tied, and

Fig. 146 represents the same incision, the parts dissected and separated to show the deep relations of the artery to (D) the vein immediately behind, and (F) the saphenous nerve. The sartorius is drawn forcibly outwards, and the artery displaced inwards.—
After Sir C. BELL.

allowed to remain, the venous bleeding will be arrested, owing to the diminished arterial supply; but the ligature so left will keep up irritation, and lead to phlebitis, obstruction of the vein, and gangrene. The accident is a very dangerous one; but we give the patient the best chance by withdrawing the needle and ligature, and passing the needle again so as to avoid the injured vein. By doing this at once, the puncture in the vein may heal, and no bad consequence follow. When the needle is so far passed round the artery that its eye and the ligature can be seen, the surgeon should seize the loop of the ligature with his dissecting forceps, and then withdraw the aneurism needle; this avoids all unnecessary traction on the vessel or destruction of its vital connections. The ligature is then to be firmly tied with the reef-knot, and both ends twisted so as to form one cord, which is brought out exactly opposite the point of deligation. The wound is then washed out with a little carbolised water, and its margins closed by a few points of suture. Two narrow flat pads of lint are placed, one on either side of the incision, and retained by strips of plaster, to keep the superficial in apposition with the deeper textures. The limb below the knee should be enclosed in a sheet of cotton wadding, and laid on its outer side, slightly flexed, on a water pillow moderately filled with barely tepid water. No external heat should be applied to the limb or foot.

Ligature of the femoral lower down, in Hunter's canal, is only performed in exceptional cases. I have referred formerly to a case of varicose aneurism, where I tied the femoral both in Scarpa's triangle and Hunter's canal, so as to include the aneurism between the deligated points; and the details of the operation are given in the Clinical Cases illustrative of the treatment of aneurism. But the cases where ligature of the femoral in Hunter's canal is required are very rare. When, however, the surgeon finds it necessary to perform such an operation, it may be accomplished in the following manner:—The surgeon having ascertained the position and breadth of the sartorius muscle, as in the higher operation, makes an incision fully three inches in length along its *outer* margin. This incision should divide the integuments, superficial fascia, and fat only. The operator next incises the fascia lata to the same extent, so as fully to expose the edge of the sartorius. It is well to bear in mind that, owing to the form of the limb, the outer edge of the sartorius lies more internally than might be supposed, and also that the muscle is superficial, and only enclosed in a thin layer of fascia lata. I mention these points, because, if the incision be made deeply, the fibres of the vastus internus may be mistaken for the sartorius,—a mistake which I have often seen made by students operating on the dead subject. If the fascia be strong, it is advisable to divide it across the line of the sartorius by a small transverse incision about the middle of the longitudinal one, to allow of the muscle being drawn fully to the inner side, as, at the part where the artery is to be tied, the sartorius does not merely overlap, but completely covers the aponeurotic canal enclosing the vessels. When the sartorius has been separated and drawn inwards, the strong tendinous aponeurosis forming the anterior wall of Hunter's

canal is exposed. This should be carefully opened with the point of the knife, and then slit open more fully with a probe-pointed bistoury, to avoid all risk, as the aponeurosis is very closely applied upon the contained vessels. The proper sheath of the vessels is then opened, and the armed aneurism needle passed with the same precautions as in the higher operation, and the treatment of the wound and limb is similar in both cases.

When, from any cause, as in my case of traumatic varicose aneurism formerly alluded to, the sartorius is adherent, so that it cannot be fully drawn aside, I would advise its complete division to facilitate the deligation of the artery. The adhesions above and below would prevent the divided ends retracting very far from each other, and union ultimately would take place with little, if any, loss of muscular power, whilst we would avoid unnecessary manipulation in the vicinity of the vessels.

In tying the femoral by the direct method in a case of false aneurism or for wounds, the incision should be free, to enable the surgeon to see the parts distinctly, so as to avoid injury of the vein. The artery is commanded above by the tourniquet, and the sac of the false aneurism opened in accordance with the general principles laid down in Lectures XLII. and XLIV., vol. I. In cases of circumscribed false femoral aneurism I have already indicated my reasons for preferring ligature of the femoral on the Hunterian principle in Scarpa's triangle.

The principal anastomoses which restore the circulation in the leg and foot after ligature of the femoral artery, are—1. The long descending branches of the external circumflex artery inosculating with the superior external articular of the popliteal and with other small branches of the popliteal at the outside and front of the knee. 2. The obturator artery and descending branches from the internal circumflex, with muscular branches, and with recurrent branches from the *anastomotica magna* below. 3. The arterial chain of communication formed by the three perforating arteries inosculating with each other, and superiorly with the gluteal, sciatic, and transverse branches of the external circumflex, whilst inferiorly they communicate with the articular and other branches of the popliteal artery. 4. The anastomoses of the terminal branches of the profunda with the *anastomotica magna*, the superior articular, and other branches from the popliteal. The tibial recurrent and the inosculations of the *anastomotica magna* with the articular arteries, assist, especially in cases where, as in popliteal aneurism, some of the articular arteries are obstructed at their origin from the popliteal.

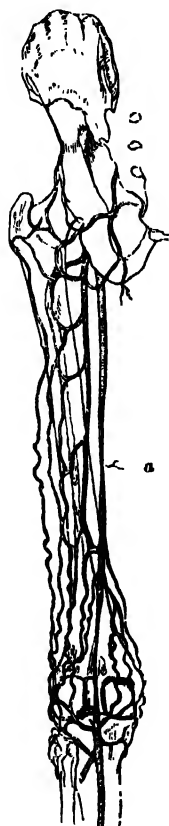


Fig. 147.

Fig. 147. Collateral circulation shown in the thigh. At *a*, the femoral artery has been obliterated by ligature.

Ligature of the arteries of the leg is seldom required, except in cases of wounds, or of false aneurism resulting from wounds, and as the wound should in general form part of our incision in such lesions, this will modify the operative procedure in different cases. Nevertheless, as in the arteries of the forearm, the line of incision should come as directly as possible upon the wounded vessel, and be determined by certain anatomical guides. I shall therefore describe very briefly the operations for exposing and tying these arteries.

The popliteal artery, almost immediately after it has passed beyond the lower margin of the popliteus muscle, divides into the anterior and posterior tibial arteries. The ANTERIOR TIBIAL ARTERY passes directly forwards through the interosseous membrane, and then continues to pass downwards, lying upon the anterior surface of that membrane, in a slightly oblique course from above downwards and forwards, till it reaches the fore part of the ankle, where it receives the name of dorsal artery of foot. In this course the vessel with its *venæ comites* is very deeply seated in the upper two-thirds of the leg, having the anterior tibial nerve at first external and then crossing it in a very oblique manner, so as to lie rather in front for a considerable distance. It lies at first deeply seated between the outer side of the tibialis anticus muscle and the extensor digitorum communis; and, owing to the prismatic form of the tibialis anticus, the broad superficial part of the muscle fairly overlaps the vessel. Lower down in the leg the extensor proprius pollicis, arising from the fibula and interosseous membrane, intervenes between the extensor communis and the artery, so that, for nearly the lower three-fourths of the leg, the artery is placed between the extensor of the great toe and the tibial muscle. Nearer the ankle the tibial muscle, becoming tendinous, passes forwards and inwards, out of relation to the artery, which then lies between the extensor of the great toe and the common extensor of the toes, the former to its internal side.

The best guide to the position of the anterior tibial artery, either at the upper or middle parts of the leg, is the outer edge of the tibialis anticus. This muscle is very broad above, and narrows as it descends.

Operation.—To tie the artery in the upper fourth of its course, the surgeon should make a long incision, slightly oblique, so as to follow the margin of the tibial muscle. This incision should not pass deeper than the surface of the aponeurotic fascia binding down the muscles, so that the operator may recognise the intermuscular line which separates the tibialis anticus from the common extensor. He should recollect that the upper portion of the latter muscle is very narrow, not above three lines in breadth, and that he is very apt to open the intermuscular line between it and the peroneus longus, and thus be led away from the artery. The assistant should be desired to extend and relax the ankle alternately, so as to show the outline of the tibialis anticus, before the fascia is opened, in the intermuscular line. The surgeon, with his finger or the handle of the scalpel, then separates the muscles and makes the assistant hold them forcibly apart. This exposes the vessels and nerve at the bottom of a deep and confined wound. The artery is next cleared from its *venæ comites* and the nerve, the armed needle passed . .

and the vessel secured. I have had occasion to operate for traumatic false aneurism from wound of the anterior tibial in which its bifurcation from the posterior tibial was implicated (see Clinical Cases, page 574, Mr. G.'s case).

In the middle of the leg the vessel is reached more easily, as the depth of the interosseous space has diminished, and also the bulk and depth of the muscles. The incision is similar to that in the operation just described—along the outer edge of the *tibialis anticus*; but here the surgeon must recollect that that muscle is narrower, and that the extensor of the great toe is the muscle in relation with the vessels externally. In other respects the steps of both operations are similar.

THE POSTERIOR TIBIAL ARTERY is the direct continuation of the popliteal, and continues to descend a little to the internal side of the middle line of the leg, resting upon the *tibialis posticus* and *flexor communis* muscles, which separate it from the posterior surface of the interosseous membrane, until it reaches the hollow or arch of the calcaneum, where it terminates in the internal and external plantar arteries. About eight or ten lines below its origin, the posterior tibial gives off a large artery, or, more properly speaking, subdivides into the posterior tibial proper and the peroneal or fibular artery. This latter is very often the larger of the two vessels; in ordinary circumstances the peroneal artery descends for about two and a half or three inches parallel to and on the same plane as the posterior tibial, but gradually gets covered by the mass of the long flexor of the great toe, and so passes out of sight, and ultimately terminates in anterior and posterior interosseous branches, communicating both with the anterior and posterior tibial arteries and their mallcolar branches. When the peroneal is the larger branch it takes the same course, but a little above the ankle it emerges from under the flexor of the great toe, and again joins the posterior tibial; so that, however small that vessel may be in the upper part of the leg, it is always found of large size behind the inner ankle. The great posterior tibial nerve descends almost exactly in the middle line of the leg, so that it lies immediately external to the posterior tibial artery and its accompanying veins, and internal to the peroneal artery—in other words, exactly between, and in close relation to, both these vessels, so that it forms an unerring guide in the deep part of the wound, by which we may reach either vessel. The vessels and nerve are separated from the soleus by a layer of thin but strong fascia, which binds them to the deeper muscles. Then they are covered by the soleus and *gastrocnemius* muscles, fascia, and skin. Lower down, where the muscles of the calf of the leg have terminated in the *tendo achillis*, the posterior tibial is covered merely by the skin, superficial and deep fascia, and its course can be readily recognised by its pulsations.

The plan of operation which is very generally advised for tying the posterior tibial in the upper part of its course, is by means of a long incision through the integuments, corresponding to the external or fibular border of the tibia, next dividing the fascia, and drawing outwards the inner margin of the *gastrocnemius*, and then either detaching the tibial

origin of the soleus from the bone or dividing its fibres from the surface towards the artery.

I consider that such a plan is not well suited to effect the purpose in the living, and that the direct plan recommended by the late Mr. Guthrie is much better, as enabling us to reach the vessel more directly, and really with less disturbance or dissection of parts; whilst, if it happens that the peroneal is the vessel requiring to be tied, that can be effected without any alteration of the original incision. I have four times had occasion to tie the posterior tibial—and from my experience in these cases, I have no hesitation in recommending the mesial or direct operation. In one of these cases the vessel required to be secured in a lacerated wound, and hence the direct operation consisted merely in enlarging the original wound and tying the vessel. In another the operation was undertaken to secure the posterior tibial at its highest point on account of an arterial erectile tumour, apparently directly connected with it. In that case the posterior tibial was found to be very small, and its ligature produced no effect on the pulsation of the tumour; but, having taken the direct method, all I had to do was to clear the parts to the outer side of the posterior tibial nerve, and tie the peroneal, which was nearly thrice the size of the tibial. Had I followed the lateral incision, and the exposure of the parts been less complete, the operation would have been very much more complicated.

The plan of operation which I followed on that occasion, and which I would recommend, was as follows:—I made an incision about six inches long, through the integuments on the back of the leg, dividing the skin and fascia. The posterior saphena vein was then cleared and held aside, and the incision continued, so as to separate the two heads of the gastrocnemius, to the extent of the superficial wound. Only one or two small vessels required to be secured. I next divided the fibres of the soleus directly from behind forwards, till I recognised its deep aponeurotic surface. This I divided cautiously about the middle of the wound, and then, with a probe-pointed bistoury, dilated the opening upwards and downwards to the full extent of the superficial incision; two or three small muscular branches were secured, and the deep fascia slit up. The pulsating tumour then projected and filled the wound, but was gently held aside, and rendered less turgid by compression on the femoral. The posterior tibial nerve was now very distinctly seen, and the posterior tibial and its veins readily recognised and the artery tied; but, as I have said, it was very small and produced no effect. Seeing this, I slightly dissected the tissues on the outside of the nerve, and drew aside a vein which hid the peroneal artery, exposed that vessel, and tied it. The presence of the erectile tumour in this case rendered the operation more difficult than in ordinary circumstances; yet the comparative ease with which the vessel was reached, and the parts at the bottom of the wound seen, render it in my estimation infinitely superior to working in a confined wound, the most important part of which is very imperfectly exposed. There is really no division of muscular fibres, except in the case of the soleus; for the two origins of the gastrocnemius are merely separated along their aponeurotic line.

of union, and the tendon of the plantaris drawn aside. Of the other two cases I have referred to, one was ligature of the posterior tibial for a diffuse false aneurism, proceeding from a wound of the posterior tibial, close to its origin. The last was a recent wound of the artery, very high up. In both the direct method was adopted (see *Clinical Cases*, pp. 570 and 574).

To tie the artery behind the inner ankle, the surgeon makes an incision of two inches long, placed nearly midway between the inner side of the tendo achillis and the inner border of the tibia and internal malleolus, care being taken to avoid the saphena vein. When the integuments and fat are divided, the strong aponeurosis which covers in the vessels is brought into view and slit open, the posterior tibial nerve is seen; and lying nearer the tibia, just behind the sheath enclosing the tibialis posticus and common flexor tendons, is the artery, with accompanying veins, from which it can be readily separated, and the ligature passed and tied.

CLINICAL CASES

ILLUSTRATING THE TREATMENT OF INJURIES OF ARTERIES.

WOUNDS OF ARTERIES—from *Clinical Report*, 1865-6.

1. C. C., *æt.* 5, admitted 4th December. Was kicked by a horse on the inner side of the left thigh in the lower third. Wound bled so profusely that she fainted, after which the bleeding ceased. When conveyed to hospital, Mr. Spence, on examination, found the wound to be small and transverse in direction. On introducing his finger he discovered that the femoral artery had been completely torn across, and that its lower portion was retracted into the popliteal space, while at the same time the upper portion was felt beating in the upper part of the wound. The vein was also divided, the contiguous muscles were lacerated and bruised, and the bone laid bare. Leg cold; no pulsation in tibials. Mr. Spence immediately enlarged the wound, and, tracing the course of the artery, tied both ends, the one in the popliteal space, the other in Hunter's canal. The limb was wrapped in wadding, and laid on a soft pillow; the wound dressed with tepid water, and afterwards with lotions. Ligature separated on the twelfth day. No hæmorrhage. Dismissed cured.

2. M. P., *æt.* 17, admitted 21st May. Two weeks previous to admission this patient received a wound in front of the right elbow-joint, from a piece of broken glass. The bleeding, which was very profuse, was arrested by cold, and by direct pressure. It recurred, however, twice the same week, and also on the day of admission. When brought to the hospital she was very anæmic, and had a small feeble pulse. Mr. Spence, on enlarging the wound, perceived a small puncture in the brachial artery just above the point of bifurcation, from which blood issued when the tourniquet was relaxed. The vessel was tied above and below the opening. The ligatures separated on the fourteenth day. The patient made an excellent recovery.

3. Mrs. F. was admitted 22d April, with an incised wound over the course of the right ulnar artery, a little above the wrist-joint. The hæmorrhage, which was profuse at the time, had ceased. On separating the lips of the wound, however, and sponging it out thoroughly, the blood jetted through a small opening which had been made in the vessel. A double ligature was applied, and the limb laid on a Gooch's splint. Dismissed cured.

4. D. S., while at work in a quarry, was struck by the sharp edge of a spade on the outer side of the left wrist. The radial artery was divided in the hollow between the phalangeal extensors of the thumb. Both ends were searched for and tied. Cured.

5. M. H., a nurse in the surgical wards, had the right radial artery

divided in the lower third, by a piece of a soda-water bottle, which burst while she was drawing the cork. Mr. Spence, who was in the wards at the time, immediately secured the vessel above and below. Erysipelatous inflammation attacked the hand and forearm, ending in suppuration on the back of the hand. Cured.

6. J. V. received a deep punctured wound in the textures lying between the metacarpal bones of the thumb and fore-finger. The wound bled considerably at the time, and on three subsequent occasions the bleeding issued from the bottom of the wound as if the radial had been opened into. On admission—there being no hæmorrhage—pads were placed on the radial and ulnar vessels at the wrist, also on the wound, which was on the palmar surface, and on the dorsum directly opposite. The pads were secured by bandaging, the limb elevated and the elbow flexed. After this there was no recurrence of hæmorrhage. Cured.

7. W. B, æt. 45, a brewer, received a punctured wound over the ulnar side of the superficial palmar arch. The patient was admitted a week after receipt of the injury, on account of repeated attacks of hæmorrhage. Pads were placed over the vessels and wound, as in the case of J. V. Bleeding did not recur, but acute inflammation set in afterwards along the course of the synovial sheaths of the muscles of the forearm, terminating in suppuration. The matter was evacuated by a deep incision a little above the wrist. Dismissed cured.

8. A child, aged eighteen months, had received a wound of the radial artery in the lower third of the forearm eight days before it was brought to the hospital. The bleeding had been arrested at first by a compress and bandage, but repeated hæmorrhage had occurred. The infant was much exhausted. The pressure had caused sloughy ulceration of the wound, and there was considerable inflammatory thickening and an erythematous blush on the surrounding skin. It was evident, however, that ligature was imperative, and I therefore enlarged the wound upwards and downwards, and cleared the artery above and below, so as to tie it where the coats were still healthy. Simple tepid-water dressing was then applied. Everything went on favourably: the ligature separated on the seventh day without any hæmorrhage, and the wound contracted and healed rapidly.

This case affords an instructive example of the danger of trusting to compression instead of tying the wounded vessel at once, especially in the case of a child, where the integuments soon ulcerate under firm compression, and where the loss of even small quantities of blood is so dangerous. Moreover, the effects of compression always render the vessel less fitted for ligature, and the operation, so simple if performed in the first instance, is rendered difficult from the inflamed adherent, and altered character of the surrounding parts; and if the ulcerative action continue in wound, the risk of secondary hæmorrhage is considerable. Fortunately, in most cases, as in this, the ulceration ceases after ligatures are applied, when compression is no longer necessary.

Remarks.—Even in recent surgical works, a rule is laid down that in primary hæmorrhage no attempt should be made to tie the wounded artery unless it be bleeding. This law is certainly very applicable to small bloodvessels to which there is no direct guide, and which may be generally trusted to nature and compresses. But where the artery is of such a size as the radial or larger, there is no security from hæmorrhage without ligature or acupressure of the vessel; and if, from the position and direction of the wound it be suspected that the arterial

trunk has been opened into, the incision should be enlarged in the direction of the course of the vessel, and a ligature applied if necessary. Two of the above cases illustrate this modification of the rule,—the one shows the necessity of a careful examination of the wound, and the early application of the ligature ; the other indicates the risks arising from delay. In C. C., the wound looked at first sight trifling. It was situated rather low down in the thigh to lead to the suspicion that the femoral was opened into, and, but for the blanched appearance of the child, and the mother's statement that there had been a great loss of blood, the real danger might have escaped observation. In order to examine the injury thoroughly, the patient was placed under chloroform. On inserting the finger into the wound it was found to pass obliquely upwards, and on tracing the lacerated tendon of the adductor, the sartorius was felt divided, and the end of the femoral artery pulsating in Hunter's canal. In addition to this, a large accompanying vein was torn across, and the shaft of the femur was laid bare at the seat of injury.

Although, under these circumstances, there was great liability to gangrene of the limb, it was not deemed proper to adopt severe measures in the first instance, inasmuch as the patient was young, the bruising of textures limited, and there was no great effusion of blood to compress or prevent the collateral circulation. The wound was therefore extended in the direction of the course of the main vessel, and one end secured in Hunter's canal ; the other, which had retracted into the popliteal space, was followed and tied. The recovery of the patient was uninterrupted and complete ; but if the rule stated above had been neglected, there is every probability that on the restoration of the natural force of the circulation, the clot would have been broken down, the hæmorrhage been repeated, and the already exhausted child have succumbed under the further loss of blood. In the second case, M. P., a wound of the brachial artery was treated in the country for two weeks with compresses and bandage ; but during that time there had been repeated attacks of hæmorrhage which greatly exhausted the patient, and the wound had assumed such an unhealthy appearance that it was impossible to continue the treatment. From the position of the wound over the bend of the arm, and from the occurrence of repeated bleedings per saltum, there could be little doubt that the brachial was opened into. In order to tie the bleeding vessel the incision was extended, and the infiltrated textures separated by the finger. The round tendon of the biceps was then felt to be completely divided, and the semilunar fascia stretched and nearly entire. I divided the fascia over the artery, and broke down the recent lymph. After this, when the tourniquet was relaxed, blood was seen to issue from a puncture in the side of the brachial just above the bifurcation. A ligature was therefore applied above and below the opening. The arm was kept in a flexed position, in order to promote the union of the biceps. After this there was no recurrence of the hæmorrhage. In this patient the operation was much more difficult than in the former, on account of the infiltrated state of the tissues, and the great difficulty experienced both in separating them and in recognising the various textures.

Two instances of suspected wound of the palmar arch (J. V. and W. B.) were admitted some days after receipt of the injuries. As the patients were strong men, and little affected by the hæmorrhage, there was no great risk from bleeding, so long as they were under direct observation. Compresses were therefore placed directly over the wound, and over the radial and ulnar arteries, and secured by a firmly-applied bandage. This, combined with flexion and elevation of the limb, proved sufficient to prevent further hæmorrhage. If bleeding had supervened, it would probably have been impossible to apply a direct ligature to the wounded vessels, and failing this, it would have been necessary to cut down and tie the brachial.

CASE OF LIGATURE OF THE AXILLARY ARTERY FOR HÆMORRHAGE, RESULTING FROM A BURN OF THE ARM.

David Henderson, æt. nine years, met with a severe burn of his left arm on the 20th December 1845, owing to his clothes taking fire.

In the absence of Mr. Kerr, the usual medical attendant of the family, another medical gentleman dressed the wound with cotton wadding; but owing to the offensive smell of the discharge, and in order to see the full extent of the injury, Mr. Kerr removed this after some days. He then found that the true skin was very severely injured, and that the burn extended from the lower part of the axilla to near the hand, and in the upper arm that it was chiefly situated towards the inner side.

Stimulating applications and poultices were then used, and in a short time sloughs separated from the injured surface above and below the bend of the arm, and the sore healed kindly enough at several points. At the bend of the arm, the sloughs were very deep and long in separating, and Mr. Kerr watched their separation with considerable anxiety for fear of hæmorrhage taking place.

On the evening of the 6th of January 1846, a portion of slough came away, and was followed by considerable loss of blood. Mr. Kerr and Dr. Duncan saw the boy shortly after this, and as the bleeding was then evidently venous, they arrested it by bandaging from the fingers upwards, and placing a graduated compress over the bleeding point. This completely arrested it until the evening of the 8th January, when a deeper portion of slough separated, and sudden and profuse hæmorrhage took place. Mr. Kerr attended almost immediately, and seeing that the bleeding was now arterial, arrested it by compressing the humeral till I arrived, but the child had already lost a very large quantity of blood. On examining the arm, the whole extent of the limb, from the lower margin of the axilla to the hand, exhibited the effects of the burn, being raw and discharging freely. On removing a piece of lint from over the bend of the arm a deep cavity was exposed, and at the bottom of it the brachial artery was seen, with a small oval opening in its interior wall. When the pressure on the brachial was relaxed, a jet of blood came from this opening, so as to leave no doubt as to the source of the hæmorrhage. From the appearance of the opened vessel, and the sloughing state of the surrounding parts, I considered it improper to trust to ligature immediately above and below the opening; whilst the state of the arm, together with the impaired vitality of the skin and other tissues, rendered ligature of the brachial in the middle, or higher in the arm, equally inadvisable. I therefore determined to tie the axillary in the third portion of its course, where it lies

on the tendon of the latissimus dorsi, and with this view the arm was separated from the side, and extended as far as could be done under the circumstances.

I made an incision about $2\frac{1}{2}$ inches long, commencing about an inch and a half within the anterior margin of the axilla, and carried down along the inner edge of the coraco-brachialis; the fascia was divided to the same extent, and the plexus of nerves brought into view. I next separated the median and internal cutaneous nerves, and exposed the vessel, and after carefully clearing it, passed a ligature round and tied it. There was a good deal of troublesome oozing of blood during the dissection, owing to the raw and vascular state of the skin at the lower part of the incision, and considerable delay and annoyance were caused by the unmanageable state of the patient (who, I should have mentioned, was deaf, dumb, idiotic, and epileptic). At the commencement of the operation he thought proper to amuse himself by blowing out the candle, and when I was about to pass the ligature round the artery he took an epileptic fit.

After the vessel was tied the edges of the upper part of the wound were brought together by points of suture, and the ligature allowed to hang out at the lower part. After waiting a short time slight bleeding was noticed to take place from the lower part of the opening in the brachial artery. I therefore placed ligatures above and below the opening, as compresses seemed to give rise to much irritation, and as I trusted there might be sufficient vitality of the coats of the vessel there to sustain the ligatures for a day or two till more permanent changes at the part, and in the collateral circulation, had taken place. The burned surface was then dressed with a stimulating lotion.

Next day I found that the patient had passed a very restless night, constantly moving the injured arm, but no further bleeding had taken place. On the evening of the 11th January, the ligatures above and below the opening in the brachial artery came away, but no more hæmorrhage took place. The ulcerated surface at the bend of the arm healed kindly.

The edges of my incision at the lower part, where it had reached the injured skin, looked sloughy; but the upper part of the incision, corresponding to the point where the vessel was tied, had united, and I removed the stitches. As the patient still continued restless and unmanageable, constantly moving the arm and disturbing the dressings, it was found necessary to muffle the opposite hand and secure the injured arm towards the side. The sloughy appearance of the lower part of the incision increased for some days, and gave me some anxiety. Stimulating dressings were applied to it, and on the ninth day after the operation, a slough separated which relieved our fears, as it was found not to extend deeper than the skin, and the parts beneath were healthy in appearance; from this time everything went on well, in spite of the unfavourable nature of the case and the unmanageable state of the patient.

The ligature from the axillary came away on the sixteenth day after the operation, and the incision healed rapidly. After this I did not attend him, but Mr. Kerr informs me that cicatrization of the whole surface was not effected until the end of February, and that now the contraction of the hand and forearm towards the shoulder is very great. He also mentions that, strangely enough, the first time the boy was left alone, he ran to the fireplace (fortunately empty), and thrust his injured arm between the bars of the grate.

Remarks.—In this case, it will be observed that, whilst the injured vessel was situated, as regarded retrograde bleeding, much in the same circumstances as an artery wounded by a cutting instrument, it differed

from it in this material point: The vitality of its coats was impaired, and these partook of the weakened action of the surrounding parts from the effects of the burn, so that I could not have trusted to ligature above and below the opening, because the action of the ligature on the vessel would have proceeded too rapidly, and the impulse of the circulation would, in all probability, have caused secondary hæmorrhage in a day or two, on the decidence of the ligature. On the other hand, ligature of the arterial trunk higher up, whilst it would have arrested the flow of blood from the upper part of the vessel, would not have sufficed to arrest the retrograde bleeding. I therefore adopted the practice of tying the main trunk high up, where it was healthy, and situated amongst healthy parts, in order to divert the impulse of the blood from the canal of the wounded vessel. The ligatures above and below the opening at the bend of the arm prevented the retrograde bleeding sufficiently long to allow of consolidation of the surrounding textures, and permanent obliteration of the vessel, obviating the necessity for bandaging and compresses. The necessary dressings to the general burned surface were not interfered with. Of course the nature of the agent causing the sloughing must be taken into consideration, as this may materially influence the line of practice.

Whilst writing out these remarks, I was called to a young gentleman in the country, who, by applying nitrate of silver over the course of the radial artery, had opened that vessel. The eschar separated whilst he was out shooting, and he had lost a very large quantity of blood. In this case I merely cut down upon and tied the vessel a short distance above and below the wounded point, because I knew that the adjacent structures, after the separation of an eschar caused by nitrate of silver, are generally in a state of healthy action, and not in that condition of impaired vitality which characterises the tissues implicated in a severe burn by fire.

INJURY OF THE AXILLARY ARTERY FROM FRACTURE OF THE NECK OF THE HUMERUS.

Mr. J. B., aged sixty-three, in coming down stairs from the drawing-room, tripped on the carpet, and fell down with his whole weight on the elbow and point of the shoulder. I was sent for on the part of Dr. Lawrie, who attended the family, and on examination I found the humerus broken at the neck, the broken end of the shaft considerably displaced inwards to the axilla, and the elbow tilted outwards.

Mr. B. was exceedingly sick and faint, having only a short time previously recovered from a severe attack of rheumatic fever, and suffering at the time of the accident from bowel complaint.

The fracture was readily adjusted, scarcely any force whatever being necessary to extend the shaft of the bone and withdraw it from the axilla. I put it up in the usual manner, with a soft compress in the axilla, placing the forearm in a sling, and confining the arm and elbow to the side by means of a broad soft shawl. I then ordered him an opiate to arrest the diarrhœa, and left him.

Next morning I saw him with Dr. Lawrie. He had passed a very restless night owing to the bowel complaint, and also from pain at the fractured part,

and numbness in the hand. On loosing the bandages, the hand and forearm were found not much swollen, but they were much colder than those of the opposite side, and no pulsation could be felt either in the brachial, radial, or ulnar arteries, at any point, but distinct and full pulsation could be felt in the axillary immediately above the fracture; there was considerable ecchymosis and bruising over the point of the shoulder and deltoid, also some swelling along the inner side of the biceps, but there was no pulsatory movement in the swelling, nor any appearance of its communicating with the artery. It was evident, however, that the axillary had suffered, that circulation through it was obstructed, and that the treatment of the fracture must be considered secondary to that of the injury of the vessel. I accordingly did not replace the pad in the axilla, but got a soft cushion made sufficiently long to reach from the axilla to the hand, jointed at the elbow, and thicker above than below. This I placed on the inner side, and another soft cushion and thin pasteboard splint on the outer side of the arm and forearm. The elbow was kept only slightly bent, the splint and cushions secured with slip-knots, and the whole limb covered with flannel.

This plan, whilst it interfered but little with the restoration of the circulation through the collateral branches, kept the broken ends of the bone pretty well in position. I continued it for the first fifteen days, when, although I could feel no pulse in the larger vessels, I was satisfied, from the restored heat and sensation of the part, that the circulation was re-established sufficiently to allow of the ordinary apparatus being used. Accordingly, I replaced a soft elastic hair-cushion in the axilla, and a leather splint, well padded, along the outside of the arm and forearm (from the point of the shoulder to the extremity of the fingers). The forearm was supported in a sling, and the arm kept to the side by a soft shawl.

Under this treatment the patient went on favourably, except that, about the end of the third week, he complained much of severe pain in the part, and of a sense of suffocation, and a feeling of weight across the chest, which he attributed to the position of the forearm across the body. The sling was lowered so as to change this position, but still the feeling continued; alterative medicine was given with some relief.

As it became of great importance for him to get home to London at this time, and as the union of the bone seemed sufficiently firm to warrant his removal, he left Edinburgh, with my consent, on the 17th of August. Since then I received the following accounts of his progress from his usual medical attendant, Dr. Bower of Hatton Garden, and subsequently from Mr. Liston, to whom I had requested him to apply; but whom he had not consulted till 1st October.

“As Mr. B. has now been under my watching more than a month, I am able to give you an account of his progress more satisfactorily than if I had written sooner. The callus around the fracture is completed, and he begins to move his arm somewhat, and in time doubtless it will turn out all right. I cannot, however, say as much for the circulation through the forearm and hand. I can only distinguish a very faint pulsation in any artery beneath the fracture. At the wrist there is none either in the radial or ulnar, and therefore I suppose the circulation through the hand must be by means of the interosseous or carpal. As you may suppose, the hand is not properly supplied, and much colder and more useless than it otherwise would be. I have adopted gentle friction and warm clothing to remedy this, but I expect more benefit from time than from either.

"From this statement I think you will agree with me that, considering the severe nature of the injury, he is doing well; and as I do not perceive any symptoms of disease or aneurism in the brachial artery, I trust he will go on uninterruptedly to recovery."

October 1st, 1847.—Yours, dated 17th August, only came to hand this morning.

"Mr. B.'s case is a very interesting one, and one that must have required anxious and careful management. It is a capital cure; there is pulsation in the brachial, and a certain thrill at the wrist; there is a good deal of œdematous swelling on the inside of the arm, and in the sheath of the biceps, but I can detect nothing wrong in the axilla; no tumour, no unusual beating; so far so good. I should not apprehend any formation of aneurism now."

Remarks.—The complication of fracture of the neck of the humerus, with the untoward injury detailed in the foregoing case, is fortunately of very rare occurrence, and I cannot help attributing it, in the present instance, more to the state of the vessels in this gentleman, than to the effects of direct injury of the artery by the broken end of the bone; in other words, I consider that the internal and middle coats of the vessel, softened and altered in structure by the previous rheumatic affection, had given way, at the time of the injury, from indirect violence, whilst the cellular coat had been stretched and twisted so as to obstruct the flow of blood through its canal. I am led to this conclusion by the following circumstances in the case:—1st, There was no unusual swelling or appearance of extravasation in the axilla at the time of the accident, as would have occurred had a large vessel been torn through by the sharp fractured end of the bone. 2d, Though the displacement of the shaft was considerable, it was not greater than I have frequently seen in fracture of the neck of the humerus, and, owing to the faintness of the patient, there was little or no force required to extend it, and produce coaptation. 3d, No false aneurism has subsequently formed, which would also have probably been the case had all the coats of the artery been torn by the broken end of the bone.

Mr. B. lived for many years after the accident. He perfectly regained the use of the arm, but the circulation in the brachial, radial, and ulnar arteries always continued very weak, the pulse being scarcely perceptible; but the limb seemed well nourished and of fair temperature.

INJURY OF THE BRACHIAL ARTERY IN A CASE OF SIMPLE FRACTURE—AMPUTATION.

David B., æt. 6, was run over by a light van, and sustained a simple fracture of the humerus. The case was seen immediately on admission by Dr. Broster, now of Southampton, who was then (1860) my resident surgeon. The fracture was easily reduced, but the limb was noticed at the time to be very cold; but as the temperature of the whole body was low from the effects of shock, Dr. Broster advised the friends to leave the child in the hospital to be watched. This the father refused to do, but promised to bring

the child to the hospital next day. Dr. Broster, accordingly, after adjusting the fracture, enveloped the limb in wadding, and applied splints, but was careful to bandage very lightly.

The father brought the boy to the Infirmary next day, when I found the injured arm quite cold, livid, and pulseless—whilst the general circulation was re-established of course by this time.—There was no fever present. The limb lay straight, and showed only a little swelling on the inner side. The father could not be convinced of the necessity for amputation, but consented to leave the boy in the hospital. The splints were removed, and the limb simply wrapped in cotton wadding. Next day the discoloration of the hand and commencing decomposition convinced the friends of the true state of matters, and I amputated the arm immediately below the tuberosities of the humerus. The little fellow recovered without a single bad symptom.

Remarks.—On dissecting the limb, the brachial artery was found to be torn across at the point corresponding to the fracture of the humerus; a sharp point of the bone seemed to have caused the injury. There was some extravasation along the course of the vessel on the inner side of the arm, but it was limited and flattened by the fascia, so that there was not much apparent swelling during life.

The occurrence of lesion of an artery in cases of simple fracture is not common, but the foregoing case, and that of Mr. B., show that it may occur; and this risk forms one of my objections to the use of the stucco or starch bandage in the early stage of fracture. Had such treatment been adopted in this case, the gangrene would have spread unnoticed till too late to admit of successful interference.

CASE OF HÆMORRHAGE FROM SLOUGHING OF THE BRACHIAL ARTERY AFTER SEVERE GUNSHOT WOUND.

John D., *æt.* 34, residing at Newlands. Admitted *October* 17, 1867.

From the rambling statement of the patient, whose intellectual faculties seem in some degree impaired, it would appear that when out poaching on the night previous to his admission to the hospital, he engaged in a quarrel with another poacher. A struggle between them ensued, during which one of the guns went off close to the patient's left side. He was brought to the hospital on the morning of the following day. On examination, it was found that a large portion of integument on the lower and inner side of the arm, immediately above the elbow, had been carried away by the contents of the gun. The tendon and part of the muscular tissue of the triceps were torn off, while parts of the brachialis anticus and biceps muscles were laid bare. A large portion of the ulnar nerve was wanting. The median was exposed for about an inch, and close beside it the large brachial trunk was seen to pulsate, apparently, however, uninjured; but one of the venæ comites was opened. There was great laceration of the skin and deeper-seated textures, but the bone was untouched. It was decided that amputation was not imperatively called for, and that, with rest and proper treatment, a useful limb might be saved.

Oct. 18.—Patient feels very little pain from the arm. Wound looking slightly sloughy. Pulse 106.

Oct. 23.—Wound sloughy. Tongue coated. Pulse 124.

Vespere.—Hæmorrhage occurred from the wound about 5.45 P.M., but was immediately arrested. Mr. Spence was sent for; and, finding that the bleed-

ing proceeded from the brachial artery, he cleared the vessel and tied it above and below the opening. Very little blood was lost.

11 P.M.—Temperature of the hand and forearm equal to that of the opposite arm. Faint pulse at the wrist.

Oct. 24.—At a consultation to-day, Mr. Spence's opinion (that no interference was at present required) was agreed to.

Oct. 25.—Radial artery at wrist quite perceptible. Pulse 120.

Oct. 26.—Pulse 130. Considerable sloughing taking place at lower and inner part of wound, but quite healthy near the artery.

Oct. 29.—Greater part of slough separated. Wound looking clean. Pulse 132.

Nov. 3.—Going on well. Pulse has gradually come down to 102. Ordered four ounces of port wine.

Nov. 10.—Still improving. Pulse 96. Ordered ammonio-citrate of iron.

Nov. 16.—Wound dressed with red lotion, and gentle support given with a flannel bandage. Patient allowed to rise.

Nov. 23.—This morning the back of the little and ring fingers of left hand are covered with large blisters. (The weather is intensely cold.)

Nov. 28.—Small sloughs have separated from the fingers.

Dec. 19.—Wound of arm contracted to about the size of a shilling. The little finger is now quite well. Other fingers nearly so.

Dec. 24.—Both fingers now well.

Dec. 26.—There is a vesication as large as a fourpenny-piece on the ring finger, and another of the same size on the point of the little finger.

Jan. 3, 1868.—Patient having gone on steadily improving, was allowed to leave to-day.

Remarks.—This case had many points of interest considered as a gunshot injury, but I refer to it at present in reference to the hæmorrhage which occurred from sloughing of the brachial artery. On being summoned to see the patient, I found a small clot of blood over the part corresponding to the site where the artery had been exposed, and this clot moving with each pulsation of the vessel. But, recollecting that one of the venæ comites had been wounded, and that possibly the easily-arrested bleeding might have been venous, I caused Dr. Yellowlegs to compress the brachial at the upper part of the arm, and then, having brushed away the clot, I desired him to relax his compression, when the full jet of arterial blood at once settled all doubt as to the nature and source of the bleeding. I then dissected along the course of the vessel, so as to clear it at a healthy point not too far removed from the opening. As the parts were matted and sloughy, and the vessel flaccid from being compressed above, some difficulty might have been experienced in recognising and clearing it, especially on the distal side of the opening, but for the simple and old-fashioned expedient of gently introducing a common probe through the opening into the canal of the artery, so as to render it perfectly distinct and easily cleared and secured.

The occurrence of secondary hæmorrhage from a large arterial trunk applied in an incised wound, however matted the surrounding parts may be by inflammatory action and previous attempts at compression, would scarcely induce any surgeon in the present day to think of amputation. But here the case was more complicated; for not only

was the original wound such as rendered the prospect of saving a useful limb somewhat problematical, but I knew positively that two of the most important collateral branches—namely, the inferior profunda and anastomotica magna—were destroyed; and hence the anastomoses, on which we depend for carrying on the circulation to the parts beyond the ligature, seriously interfered with. I confess that at first I merely looked to the ligature as a temporary measure to save immediate loss of blood, and allow the patient time to rally before amputating; and, as the case was likely to be a medico-legal one, I directed a consultation to be called for the next morning. However, on my visit late at night, I was agreeably surprised to find the hand of a good temperature, and a distinct, though feeble, pulse in the radial artery of the injured limb. Next morning the pulse was quite distinct, and the condition of the limb, as regarded the fully re-established circulation, such as left little room for difference of opinion as to persevering in conservative treatment.

I think that scarcely any case could better illustrate how much we may trust to vascular supply, even after many of the larger anastomoses are cut off. And when we consider the sloughy state of the wound, the impaired nervous supply from division of the ulnar nerve, and the swelling from exudation, which, to a certain extent, would press upon and obstruct the smaller vessels, together with the debility of the patient from the great loss of blood at the time of the accident, no case could well appear less favourable as regarded the prognosis.

FALSE ANEURISM OF THE POSTERIOR TIBIAL ARTERY.

History.—James A., admitted to Ward XVIII. this evening (March 2, 1871), suffering from the effects of an injury sustained six weeks ago. He was engaged in pruning a gooseberry bush with a large pocket-knife, when the knife slipped and entered the inner side of his left leg, burying itself in the calf for about two inches. He drew out the knife, and went into the house, when he observed blood gushing from the wound; he tied a bandage round the limb and so stopped the bleeding. The patient first applied to a veterinary surgeon. About eight days afterwards the patient called in a regular practitioner, who attended him for three weeks; but as the wound bled repeatedly, he was at last recommended to apply to the Infirmary, and was accordingly admitted.

On admission.—Patient very anæmic, conjunctivæ yellow, and numerous small vesicles about the leg. A small wound was found in the upper and inner part of the calf, large enough to admit the tip of the forefinger. As there was some bleeding, Dr. Pitcairn plugged the wound with lint and applied a compress, which at once checked it.

March 3.—To-day Mr. Spence proceeded to examine the wound. Immediately the dressings were taken off a gush of blood followed. An assistant compressed the femoral, but still a good deal of venous hæmorrhage continued. On inserting his finger into the wound and feeling for the bleeding point, Mr. Spence was at once convinced that both the posterior tibial artery and vein were injured. A tourniquet was applied to the femoral, the patient carried into the theatre and put under chloroform. Mr. Spence then made an incision for about eight inches along the inner aspect of the calf, dividing the gastrocnemius and soleus muscles, and exposed the vessels. While doing

so a quantity of clots and pus was evacuated from the large cavity near the wound, while the surrounding tissues were more or less disorganised. On exposing the vessels it was seen that the posterior tibial artery was injured close to the bifurcation of the popliteal, and also one of the venæ comites. Mr. Spence applied a ligature above and below the wound on both artery and vein. A ligature was also applied upon the anterior tibial, just below the bifurcation of the popliteal. The ligatures were left hanging out, a piece of lint soaked in tepid water was applied over the incision, and the foot ordered to be covered with cotton-wool, and to be slightly elevated.

4th.—Patient has passed a quiet, painless night, but had not much sleep. The circulation in the foot is very good. Mr. Spence cleared out the wound and dressed it, supporting the edges of the incision with a many-tailed bandage of lint soaked in a weak solution of chloride of soda. A piece of carbolised lint was placed between the ligature and the skin to prevent undue irritation.

5th.—Patient doing well, but has passed a restless night, the wound causing him much pain.

10th.—A ligature came away this morning. Evening: All the ligatures remaining came away this evening while the limb was being dressed.

12th.—Wound looking very healthy. Dressed with a many-tailed bandage soaked in camphorated lotion, the wound gently syringed out with weak carbolic acid lotion. General health much improved.

25th.—Wound healing rapidly. Limb still dressed with a many-tailed bandage of lint soaked in chloride of soda lotion. A bed sore, which the patient has had for the past week or ten days, on the outer ankle, is looking healthy now. Limb rests on water-pillow. General health good.

April 9th.—Wound gradually contracting. Edges kept together by plasters.

30th.—Wound healing rapidly, dressed with a narrow strip of dextrined oiled silk along line of incision and many-tailed bandage of lint. General health good.

May 8.—Wound almost healed.

14th.—To-day the patient was dismissed from the Infirmary cured.

Note (May, 1872).—When I last heard of this patient he had resumed his employment as postman in a country district, and was quite well.

FALSE ANEURISM OF RADIAL ARTERY.

John A., aged 33, a farrier by trade, was engaged in shoeing a horse, when the animal suddenly withdrew its foot, and the point of the nail, which had not yet been twisted off, entered the patient's forearm, evidently wounding the radial artery. A gush of blood immediately followed, which he stopped by placing the point of his finger over the puncture until the arrival of a medical man, who applied graduated compression. The man feeling little or no inconvenience from the wound, returned to his work, and continued at it for some days, when he was obliged to cease on account of the pain and swelling which followed.

On admission, on December 18, 1871, about a fortnight afterwards, the external wound had healed, though only covered by a thin layer of newly formed tissue, while a considerable pulsating swelling, fusiform in shape, was apparent on the front of the left forearm. A piece of lint soaked in dextrine paste was applied over the seat of puncture to prevent any chance of the cicatrix giving way, perfect rest and quietness enjoined, and a gentle purgative administered.

19th.—The patient having been put under chloroform in the ward and

taken to the theatre, Professor Spence cut down upon the radial artery, and, having turned out the coagula, tied the vessel above and below the wounded point with silk ligatures. Sutures were then inserted, the edges of the wound drawn together, and dressed with a saturated solution of boracic acid. On being carried to bed the arm was placed in the supine position on a pillow.

20th.—From this date the patient went on favourably; his pulse never rising above eighty beats per minute, while the last ligature came away on January 1.

January 3.—The wound shows a tendency to break up, and there is considerable swelling at the upper third of the forearm, probably owing to the patient injudiciously leaving bed. Pulse 88. Skin hot, and patient complains of headache.

6th.—For the last two days there has been no abatement in the feverish symptoms, nor in the swelling of the limb. There was also considerable discharge connected with the wound, which led Mr. Spence to make counter-openings to favour the escape of the pus.

11th.—There is a marked improvement in the appearance of the limb; the tension and œdema are steadily decreasing, and the patient expresses himself "much better." The wounds are dressed with the lotio sodæ chlor. and chloride of zinc.

16th.—The limb is nearly of the natural size and appearance, and the patient is able to get out of bed.

22d.—There was now no swelling whatever, and the patient left the Hospital cured.

Remarks.—The cases of false aneurism just narrated are instructive as to the treatment of wounded arteries. I think they show the propriety of immediate ligature of the wounded vessel, even although there be no bleeding when the surgeon sees the patient. It has been said that in the case of vessels such as the radial, ulnar, or tibial—or even in those of a larger size—that if bleeding has ceased or been controlled, it is not advisable to disturb the wound, but that we may trust to the natural hæmostatic processes to complete the cure. I have always looked on such doctrines as not only doubtful, but dangerous. In the case of the wounded posterior tibial artery, if a surgeon had been called in at first, how much suffering and danger might the patient have been saved had the circulation been commanded, the wound freely dilated with a probe-pointed bistoury, and the wounded vessel been secured at once? In the other case we have an instance of a smaller vessel—the radial—in which the bleeding was at once efficiently arrested, graduated compression applied, and the punctured wound healed by the first intention, without any consecutive hæmorrhage. Yet we find a false aneurism arising sometime after the injury, and requiring the vessel to be tied under less favourable conditions. Surely there can be little hesitation as to the safer plan of enlarging the wound, exposing and tying the injured vessel at once. Before leaving the case of the radial artery I would advert to the appearance of the false aneurism in that case. The swelling was of a bright red colour, and glazed exactly like an acute abscess, and, as there was considerable pain, a superficial inspection might have led a careless practitioner to plunge a knife into it. In another case of false aneurism of the radial, which was sent to my care by the late Dr. Cochrane of Auchterarder, and in which the false aneurism arose after a compound

uted fracture of the radius, which had united, the tumour presented precisely the same appearance as in the case narrated. The general appearance, together with the history, except for the pulsation, might easily have misled the surgeon to suppose that the swelling was an abscess connected with disease of the injured bone.

The case of false aneurism of the posterior tibial presents some points of interest in regard to the treatment. Prior to admission the patient had suffered from repeated losses of blood, and was exceedingly anæmic; whilst, at the same time, the enormously swollen and painful state of the limb, and the severe irritative fever present at the time of admission, left little room for doubt that putrefaction and unhealthy suppuration were going on amongst the extravasated blood. Although, when the limb was examined by the resident surgeon on the arrival of the patient at the Hospital, there had been some bleeding, it was not of such a kind as to excite alarm or require more than a clean compress to be applied to replace the dressing removed. I was therefore unprepared for the forcible gush of blood which took place when the dressing was removed. I was looking at the general appearance of the limb, when the flat compress was gently lifted off, and in an instant I felt my face deluged with blood. I at once thrust my finger into the wound, and compression was made on the femoral. Of course there could be no hesitation as to immediate action, notwithstanding the very unfavourable condition of the patient. The procedure adopted has been already described. It was the direct method, which I have always advocated—viz. enlarging the wound upwards and downwards in the course of the vessel which we suppose to be wounded. The reason which led me to make such a very extensive incision in this case was not merely to expose the artery easily, but chiefly to lay open fully the collection of coagula and fetid pus, and thus get rid of the source of "the irritative fever," and avert if possible the pyæmia which seemed to be threatened. The point at which the posterior tibial was wounded, taken in connection with the tender and swollen state of the leg and imperfect circulation in the foot, is a matter of interest, as showing how much we may trust to the vitality of tissue, even when not very healthy, and when the circulation must be carried on by the smaller arterial branches only. In this case the position of the wound necessitated ligature of the anterior as well as of the posterior tibial; indeed, properly speaking, the upper ligature embraced the lower part of the popliteal artery, and thus the arterial supply was chiefly dependent on the sural arteries and the anastomoses between the anterior tibial and articular branches of the popliteal and anastomotica magna. When we consider, moreover, that one of the large veins had been wounded, and required to be tied, and that several of the branches of the sural arteries were necessarily divided in the long incision which I made—looking also at the state of the leg and the debilitated condition of the patient—I think it will be allowed that few cases could be conceived of as less promising for saving the limb; and yet the result of this and similar cases which I have seen and recorded convinces me that amputation should never be resorted to without giving a trial to conservative measures carefully carried out.

**FALSE ANEURISM ON THE FRONT OF THE LEG FROM WOUND OF THE
BIFURCATION OF THE POPLITEAL ARTERY, SUCCESSFULLY TREATED
BY LIGATURE OF THE VESSELS IMPLICATED.**

The following case is another example of false aneurism from a wound at the bifurcation of the popliteal, inflicted from the anterior aspect of the leg. It possesses several features of interest to the practical surgeon.

On June 20, 1873, I received a letter from my friend Dr. Taylor, who was on a visit at Forres, giving me the history of the case, and asking me to come north or to advise as to treatment. The following is Dr. Taylor's account of the case:—

"Mr. G., a farmer, while out shooting on the 4th inst., made a halt, and, wishing to become possessed of a thorn branch, took out his knife and proceeded to cut it. The knife slipped and entered his leg. He was not aware that he had sustained any injury until he saw the blood, and on seeing this he tied his handkerchief round his leg, outside his trousers, and walked home. Dr. Murray was sent for, and on his arrival loosened down the leg and proceeded to clear away some clots, whereupon a gush of blood spurted out on his shirt-front. He pressed his thumb upon the wound, and on lifting it by-and-by to look for the source of the bleeding, found that it had entirely ceased. The blood which came was dark. He sent for Dr. Innes, and remained till his arrival. They found the part much swollen and pulsating. By using the stethoscope they heard a whirring sound accompanying each pulsation. Treated it with cold, rest, and bandaging.

"On Sunday, Dr. Ross, Inverness, saw it in consultation with them. Recommended acute flexion of the limb, which was kept up for two or three days, but could not be borne. The leg was therefore liberated yesterday, and placed on an inclined plane; and to-day, when I saw it, we placed it partially flexed and elevated upon pillows.

"The wound occupies the position indicated below, and is of a proportional size relatively to the limb. The area of swelling is indicated by the dotted lines, and the bruit is louder at the distal portion, and also towards the posterior aspect of the wound (2, 2), while it is less loud at the parts marked 1, 1.

"When the man stooped to cut the thorn, his knees were bent, and he was therefore in an almost crouching position; and from the limited area of the external opening, and the force likely to have been employed, I think it probable that the blade has plunged deeply, and probably entered the vein and artery both. From the character of the bruit, and the force of the impulse communicated to the swelling, it must be, I think, the anterior tibial. Of course the external wound does not

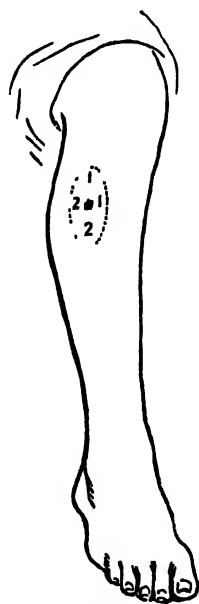


Fig. 148.

give us any reliable information regarding the direction of the wound any more than of its depth. Dr. Murray has introduced the probe, but it only traversed laterally and equally in all directions. The pulsation and bruit entirely cease when pressure is made on the femoral."

In reply to Dr. Taylor's letter I advised that the patient should be brought to Edinburgh, as, judging from the history, I thought an operation would be indispensable; and as the patient lived at some distance from Forres and from medical assistance, I considered he would be safer in Edinburgh in case of any secondary hæmorrhage or other accident occurring subsequent to the operation. Accordingly, the patient was brought to Edinburgh by Dr. Taylor on the evening of June 24. I saw him shortly after his arrival; the wounded limb had been methodically bandaged, and there had been no bleeding during the journey. He was, however, a delicate-looking man, and had evidently suffered from the previous loss of blood. As his tongue was clean, and no fever present, I decided on operating next morning, and therefore did not examine the limb or undo the bandage.

On June 25, at 11 A.M., assisted by Dr. John Duncan and Dr. Taylor, the patient having been put under the influence of chloroform, and a tourniquet applied to command the lower part of the femoral artery, I slit up and removed the bandage. On removing the lint in immediate contact with the wound there was a spurt of dark blood. I found the general appearance of the limb much as described by Dr. Taylor in his letter, but there was more swelling, and some redness of the surface near the wound. On introducing a probe it passed obliquely, deeply, back and upwards. Introducing a straight probe-pointed bistoury into the wound, I cut downwards in the direction of the outer edge of the tibialis anticus to a sufficient extent to enable me to introduce my finger. On doing this a little purulent matter escaped. On displacing some clot I felt my finger pass through the interosseous membrane at the upper part of the wound. I freely enlarged the incision upwards and downwards, in the line already indicated, to the extent of about six inches, and turned out first a mass of soft clot lying between the tibialis and common extensor muscles. This clot had separated and dilated the intermuscular space so that the wound of the interosseous membrane could be seen. At the deep and upper part of the wound a small, firm, decolorised and conical mass was found; on this being removed, and the wound sponged out, the wounded vessel was seen presenting a large oval opening, the edges of which felt thick. On proceeding to clear the wounded vessel for ligature, I saw the anterior tibial, all but separated, passing downwards along the tibialis anticus. From the direction and position of the large artery in which the opening was seen, it was obviously the posterior tibial, and the knife had evidently wounded the bifurcation from below, almost severing the anterior from the posterior tibial artery—something as shown in this diagram. Having cleared the artery, I applied two ligatures of carbolised dentists' silk, one a short distance above, and the other immediately below the opening, and a third upon the nearly divided end of the anterior tibial artery. On slacking the tourniquet blood still welled up from the opening. Supposing that the upper ligature might not fully command the large orifice I cleared the parts upwards for four or five lines, which exposed the lower part of the popliteal, immediately above the bifurcation. I passed and tied another ligature; but there was still some oozing. A small twig was seen near the deligated part of the vessel, which was also tied, but still some oozing continued from the wound in the artery. I therefore applied another ligature immediately above, almost on the opening, when all oozing ceased. The wound was then thoroughly cleansed with weak carbolic lotion, the ligatures brought out, and the margins



Fig. 149.

of the wound closed by silver sutures. A layer of waxed tissue paper was applied next the wound, and the limb enveloped in a sheet of cotton wadding and laid on a soft pillow. An opiate was given when the effects of the chloroform had passed off.

The patient went on favourably, though subject to dyspeptic attacks and flatulence. On the second day after the operation the pulse could be felt in the posterior tibial artery at the inner ankle, and the foot and limb were of good temperature. The discharge from the wound was moderate, at first grumous (as might be expected), but gradually becoming purulent. On the fifteenth day all the ligatures came away except one, and this was thrown off on the seventeenth day after the operation, without the slightest oozing of blood, and the upper part of the wound cicatrised rapidly. In the fourth week Mr. G. seemed so well that I allowed him to be taken into another room for a change. Next day, however, he was restless and feverish; his tongue was foul, pulse quick, and his temperature had risen from 98° to 101.2° . On examining the limb, which had been gradually assuming the natural size, I found it swollen and erythematous, and the discharge had a peculiar fetid smell. I therefore reopened the lower part of the wound to allow the discharge free vent, and because I suspected that some of the fascial texture was sloughy. Lint soaked in a mixture of powdered charcoal and warm water was applied over the wound, and the patient was directed to take fifteen drops of the muriated tincture of iron four times a day. Several portions of fascia came away as sloughs during the dressings, and one morning, seeing a portion

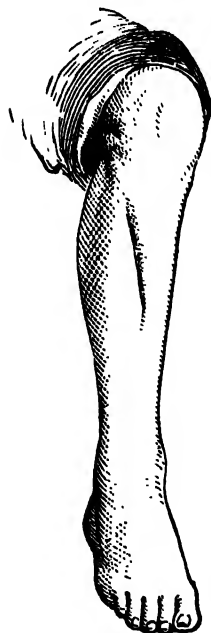


Fig. 150.

of the tendon of tibialis anticus exposed and looking sloughy, I laid hold of it with the dressing forceps to see if a portion of it were separating, when it came away from below, and in drawing it out what appeared to be the whole of the fleshy portion of the muscle came away along with it, much softened, but still retaining its prismatic form. The tendon seemed to have separated about an inch above the ankle. After this there was no more fetor, and only moderate healthy discharge and the separation of scales of bone from an exposed portion of the tibia corresponding to the separation of the tibialis anticus. The erythema and the constitutional symptoms speedily subsided. Convalescence became established, and the wound so nearly healed that Mr. G. left Edinburgh for his home on August 13, 1873—seven weeks from the date of the operation. His subsequent treatment was carried on by Dr. Murray, of Forres, from whom I heard of the patient's continued favourable progress, and ultimately that he was able for a considerable amount of walking. Being in Forres in August 1874, through the kindness of Dr. Murray, who took me to see Mr. G., I was enabled to judge of his state a year after he left my care. The injured limb is now almost equal in bulk and muscular development to the sound one. The wound is thoroughly and firmly cicatrised, but a deep depression marks the position whence the mass of the tibialis anticus had separated.

The woodcut, from a photograph, gives a good view of the limb in its present state, though, as in all photographs of cicatrices, the depth is exaggerated by the very dark shadow. All the movements of the leg are perfect, except the

power of bending the ankle and extending the toes, which movements are considerably impaired. "But Mr. G. walks for long distances without much fatigue, and is able for all the active duties of his business as a farmer.

Remarks.—I think that the character of the wound in this case presents some points of interest. There is no difficulty in understanding how a deep wound in the upper part of the leg, whether inflicted from before or behind, may involve both the anterior and posterior tibial arteries, but in that case we might naturally expect that the extravasation of blood into the limb would not be limited to one aspect of the leg, but would be more or less generally diffused. From the history of the accident and the force with which the knife was impelled, I was prepared for the risk of wound of both vessels, and, indeed, had mentioned it in my reply to Dr. Taylor's letter as one of the complications which made me advise Mr. G. being brought to Edinburgh. But when I saw the limb and felt no extravasation on the posterior part of the leg, and the aneurismal swelling limited to the anterior aspect, I came to the conclusion that the anterior tibial alone was injured; and it was only after introducing my finger and feeling the wound in the upper part of the interosseous membrane that the uncertainty of such a diagnostic presented itself. A little consideration of the surroundings of the wounded vessel at the point where it was wounded, together with the nature of the wound and the treatment immediately adopted, will explain the direction and limitation of the extravasation. The sharp knife had penetrated with full force deeply in a direction from below upwards, and almost severed the anterior tibial at its origin from the popliteal. The wound in the posterior tibial, therefore, was the result of this severance, and consequently on the anterior aspect of that vessel; thus the blood would escape without obstacle in the forward direction, whilst the cellular connections of the artery and the muscular and fascial textures around and on its posterior aspect being undisturbed would tend to prevent the blood from passing backwards. The methodical and immediate arrest of the bleeding by bandaging and flexion of the limb had prevented there being great extravasation in any direction. Thus it will be seen that the limitation of such an aneurism is not an absolutely certain diagnostic of only one of the vessels being wounded. Another point in reference to the wound of the vessel is the character of the hæmorrhage when the wound was first examined by Dr. Murray. When that gentleman removed the dressing he was covered by a forcible gush of blood, which he at once arrested by pressing with his finger in the wound, and after a few minutes, when he slowly withdrew his finger, there was no more bleeding, nor could any bleeding point be seen. Such a cessation of hæmorrhage is very apt to mislead the surgeon to suppose that only some small artery has been wounded, and that the first gush is from blood which has been confined by the dressings, but it is really characteristic of certain forms of arterial hæmorrhage. In recent wounds of arteries, such as those of the leg and forearm, if the wound be nearly parallel to the course of the vessel or slightly oblique, more or less across the circular fibres of the middle coat, when the limb is held

straight the vessel is on the stretch, and the wound in its coats becomes almost linear, and there is no hæmorrhage. Hence it often happens that while the limb is held steady for the surgeon to examine the wound, there is no bleeding point to be found, but whenever the limb is left free and the vessel relaxed bleeding again begins. A very good illustration of this will be found in Liston's *Practical Surgery*, in a case of wound of the anterior tibial artery. As regards the operative procedure I adopted, it was that which I have always advocated—to commence by enlarging the existing wound sufficiently to admit the finger to examine the state of the parts, and then to prolong the incision directly in the line of the vessel injured. In cases of false aneurism, where some weeks have elapsed from the time when the injury was received, it will generally be found that the vessel is reached with much less difficulty than might be expected, and that when the clots are removed and the parts cleansed the wound in the vessel is very distinct, presenting a round or oval opening with thickened edges, so that it may be felt as well as seen. The extravasated blood separating the parts, dilating the inter-muscular spaces, and pushing the muscles aside, prepares the parts for the surgeon; and if the skin and fascia be freely divided, the difficulties of reaching even a deep vessel like the anterior tibial at its upper part are much diminished. The enlargement of the wound in the artery arises from the manner in which the natural hæmostatic process occurs in a wounded but not completely divided vessel. In such cases there cannot, of course, be any retraction or contraction of the coats of the artery, nor plastic lymph exuded, causing cicatrisation of the divided coats, as in a vessel cut across. The hæmostatic process here is, for a time at least, limited to the formation of blood clot, and this clot forms partly within the opening in the artery, as well as in the surrounding cellular tissue; so the aperture is kept distended and blocked up by the clot until irritation of the vascular coats and plastic effusion complete the obliteration of the vessel at the wounded point. When this process proves abortive, as in false aneurism, then we can easily understand why we see a distinct aperture with defined, thickened, and rounded edges, so distinct that, in deep-seated vessels, feeling might guide us to the wounded point. But whilst I thus explain the favourable conditions in false aneurism, I would not wish to be supposed as arguing for delay in securing a wounded artery, for it must be kept in mind that delay often leads to serious risks and dangerous complications, such as unhealthy suppuration, matting, and loss of distinction of important parts in the vicinity of the wounded vessel, which may increase even the difficulties of the operation. I would observe, from the uppermost ligature being placed on the lower part of the popliteal after a very slight clearing of the textures with the knife, it seems to me that the possibility of doing this from the front of the leg must have depended on the stretching of the vessel and the dilatation of the parts, or that the popliteal must have divided rather lower down than usual; for on the dead subject I have found it very difficult to reach the vessel as I did in the above case. The only other circumstance I shall mention is separation of what appeared to be the whole tibialis anticus muscle with a large

portion of its tendop. Was this due to rapid death from loss of vascular supply? This could scarcely be the case, for it did not separate till nearly five weeks after the operation, and then the collateral supply should have been re-established. I rather incline to the belief that it arose as a consequence of the erysipelatous inflammation leading to the death of a structure, the vitality of which had been so seriously impaired in its nutrition.

WOUNDS OF THE POSTERIOR TIBIAL ARTERY, COMPLICATED WITH
A SIMPLE LUXATION OF THE KNEE-JOINT—LIGATURE OF POSTERIOR TIBIAL ARTERY—INCIPIENT GANGRENE—AMPUTATION—RECOVERY.

William M'B., aged thirty, was admitted into the wards of the Royal Infirmary under my care, at midnight, on February 28, 1872, suffering from a punctured wound on the inner side of the calf of the leg.

He stated that at the time he received the injury he was standing on a canal boat, which was passing another, and that the tow-rope caught and hurled him against the side of the boat. As he was rendered insensible at the time by the force of the fall, he could not say exactly how the wound in his leg was inflicted, but as there was an iron spike three or four inches long, he supposed he had fallen upon it.

On admission there was smart oozing of blood when the bandages were removed, and the patient was rather faint from previous loss of blood, shock, and fatigue, as he had been brought from a considerable distance to the hospital.

I saw the patient on my visit next day; I found the limb tense from extravasation, and on removing the compress a stream of mixed arterial and venous blood issued from the puncture. On commanding the bleeding by pressure of the femoral artery, and examining the wound with a gunshot probe, I found that it passed deeply upwards. On reapplying the compress and relieving compression of the femoral, the anterior tibial was felt distinctly pulsating on the instep, but no distinct pulsation could be distinguished in the posterior tibial behind the inner ankle. As the direction of the wound, the hæmorrhage, and want of pulsation in the posterior tibial artery seemed to indicate wound of that vessel, whilst there was no fracture of the bones of the leg,—nor apparently any injury but the wound of the leg,—I determined to enlarge the wound in the direction of the posterior tibial, and I accordingly had the patient removed to the operating theatre and brought under the influence of chloroform. When partially under the influence of the anæsthetic, a movement of the leg produced dislocation of the knee-joint, showing the existence of that serious lesion as well as the wound. I, however, proceeded to enlarge the wound and secure the wounded vessel in the first instance. I enlarged the existing wound to the extent of about seven inches, principally in the upward direction. This incision slit up the whole thickness of the gastrocnemius and soleus muscles, as well as the integuments and fascia, at one sweep. When the edges of the wound were drawn aside by spatulæ and the coagula sponged out, the posterior tibial nerve could be seen through the thin aponeurosis covering it, and that membrane had been partially torn over the artery. On slitting up the deep fascia I found the whole course of the vessel embedded in extravasated blood. At one point, where the clot was large, I expected to find the wound in the artery, but found that only one of its accompanying veins had been torn there. Higher up, above the point

where the fibular artery came off, an oblique slit-like wound was found in the posterior tibial. After placing a ligature above and below this, the tourniquet was slackened, when a jet of blood issued from the wounded point. The ligatures were then tied, and subsequently some muscular branches in the soleus and gastrocnemius muscles were secured.

I next carefully examined to ascertain whether there was any communication with the dislocated knee-joint, but finding no communication with the wound, I decided on giving the patient the chance of saving the limb. The luxation was easily reduced, and showed no tendency to displacement, when the patient was put to bed, and the limb laid on a soft pillow. Owing to the bulging of muscles, and being anxious to avoid all tension, no sutures were used; lint soaked in weak carbolic oil was laid over the wound, its margins gently approximated by the many-tailed bandage, and the limb enveloped in cotton-wool. The patient was directed to have an opiate, and some stimulants should the pulse become weak, but not otherwise; milk and beef-tea for diet.

On my visit next day (March 2) I found that the patient had passed a restless night, and that some small vessels had required to be tied after reaction took place. His pulse was 140 and irritable, and his expression anxious. The wound had a dry, unhealthy look, and the upper part of the leg in front indicated incipient gangrene. I now learned from further information that he had not only been knocked down by the tow-rope, but that his leg had been twisted in a right of the rope. I therefore advised him to submit to amputation of the limb, to which he readily consented.

I amputated the thigh at the lower third by a double flap, the anterior being longer than the posterior. After the amputation the symptoms gradually improved, and the patient made a good though slow recovery. The only thing worth noticing in the treatment of the stump was that I used traction by means of plaster and extension pulleys to prevent retraction of the flaps.

Remarks.—In the first instance, the indications for tying the posterior tibial artery in this case were sufficiently distinct. The hæmorrhage, direction of the wound, and such history of the accident as could be obtained, taken in connection with the free pulsation in the anterior tibial at the ankle, and its continuation on the dorsum of the foot, whilst no pulsation could be detected in the posterior tibial at the inner ankle, all pointed to a lesion of that vessel at the upper part of the leg. At the time I proceeded to operate we had no intimation of there having been luxation of the knee; that complication only showed itself whilst the patient was being brought under the influence of chloroform. Its occurrence did not alter my plan of procedure, because the free incision necessary to expose and tie the posterior tibial artery would enable me to ascertain positively whether the luxation had torn the surrounding textures so as to communicate with the wound of the leg, and so decide me as to the propriety of amputation. The presence of simple luxation of the knee coincident with a wound of the artery, though a grave complication as influencing the result, would not, in my opinion, be a sufficient ground for performing amputation in the first instance. It is true that, in simple luxation of the knee, the force causing it not unfrequently leads to rupture of the coats of popliteal vessels, more or less complete, and consequent obstructed circulation; but the pulsation in the anterior tibial, and the free hæmorrhage from the wound, sufficiently evidenced that such condition was not present.

in this case. There were no appearances on the limb to indicate the more serious injury of the leg having been caught and crushed in the bight of a warp-rope, and I only heard that statement subsequently. In such an injury, if the limb had been forcibly acted on, the appearances can scarcely be overlooked; the mark caused by the direct action of the rope, the muscular textures reduced to a pulp, and the rapid loss of vitality in the injured parts are only too obvious. Neither the skin nor the state of the deeper-seated structures in this case presented any such appearances, and I am therefore disposed to believe that the constricting action of the rope had not been in full force. I think that the gangrene which necessitated amputation most probably arose from a combination of various causes. Loss of blood, and the degree of force causing contusion of the soft parts, and dislocation of the knee-joint were, under the circumstances, likely enough to diminish the vitality of the textures and predispose to gangrene; but if the patient under such circumstances can be carefully watched, I believe that ligature of the artery and a chance given to save the limb is the proper practice to pursue.

ACUTE NECROSIS OF FIBULA; HÆMORRHAGE; LIGATURE OF SUPERFICIAL FEMORAL; RECURRENCE OF HÆMORRHAGE; AMPUTATION; RECOVERY.

Mr. A. T., aged 23 years, residing at East Linton, came under my care on the 15th of August 1862, on account of acute necrosis of the fibula, which had begun about the middle of July 1852. On Thursday the 9th September, as his general health was suffering severely, I proceeded to remove the diseased bone.

Dr. Hislop having administered chloroform, I passed a probe-pointed bistoury down to the bone, through the incision over the middle of the fibula, enlarged the opening upwards and downwards to the extent of $5\frac{1}{2}$ inches, and extracted a long sequestrum, consisting at one part—of about an inch in length—of the whole thickness of the bone. I next enlarged the upper incision to the extent of three inches, and extracted another sequestrum, but some small portions seemed still attached to the head of the fibula. There was no great amount of bleeding, and the wound was dressed with dry lint, and supported by a moderately tight bandage. I saw him again on the Saturday, and dressed the wound; there had been no oozing after the removal of the dead bone, and the wound was looking well. As I happened to be residing in the neighbourhood for a few days, his brother called on me on the Monday forenoon following, and told me that he seemed much easier, and in better spirits than for some time back. About 10 P.M., however, I received a message from his brother, stating that on reaching home he had found that alarming bleeding had occurred about a quarter to nine P.M., and that Dr. Hislop wished me to come immediately to the case.

I accordingly went, and reached the patient's house about half-past eleven P.M. He had by that time somewhat recovered from the first effects of the loss of blood under the use of stimuli, but was nervous and excited. I learned that the bleeding had taken place slowly and unnoticed until he felt sick. He was talking with his mother and sister at the time, and on his complaining of faintness they happened to look at the bed, which they found covered

with blood. Dr. Hislop was sent for, and arrested the bleeding by pressure. Having applied a tourniquet over the femoral artery, I cut up the bandage, and found the leg more swollen than when I last saw it, as if from coagula. I accordingly removed the lint from the large incision in the leg, with my finger removed the coagula, and then with a sponge cleared the large exposed surface. The edges of the wound being held apart, I directed the tourniquet to be gradually slackened till all compression was taken off the femoral. No jet of blood was noticed. I again examined the wound with my finger, and as the lymph seemed firm I placed slips of lint into the deep part of the wound, and then a larger compress, and secured them by a roller applied from the toes upwards. An opiate was then given to procure sleep.

I remained at his house all night; and at nine o'clock, before I left for Edinburgh, I saw him with Dr. Hislop. There had been no recurrence of the bleeding. I was still suspicious, however, from the amount of blood lost, and the long-continued diffuse suppuration which had previously existed, that the fibular artery might have been disorganised and given way from sloughing. I accordingly came back from town as soon as I could, and on reaching Linton I found that bleeding had just recurred to a considerable amount. Assisted by Dr. Hislop, and my friend Dr. Littlejohn, who had accompanied me, I again examined the wound. The extent of the incision enabled me to see the whole deep part of the wound, on clearing which of coagula, I found the textures generally covered with firmly adherent lymph, but some of the deeper parts looked sloughy and unhealthy. The bleeding welled up from the surface of the wound, but not in a jet. The patient's state demanded that some decided measures should at once be adopted, since direct graduated compression had failed. As to direct ligature on the bleeding point, although I suspected the fibular artery, yet, though the large incision exposed the surface of the wound fully, there was no jet or distinct indication of bleeding from any one point, whilst the disorganised sloughy condition of the deep surface of the wound rendered it more than doubtful whether a vessel, if discovered, would have held ligatures. There remained, therefore, only the alternatives of ligature of the femoral artery, or amputation. The latter, from the state of the patient and the extensive suppurating surface, might ultimately be necessary, even for other reasons; but I was very unwilling to sacrifice the limb, and, moreover, from the faint condition of the patient at the time, he would not have been able to bear the operation. I therefore determined to tie the superficial femoral, in order to control the general circulation of the limb, and to assist it by moderate graduated pressure directly applied to the wound. The patient having been brought under the influence of chloroform, I at once proceeded to tie the vessel, which was readily accomplished without removing the patient from bed. All oozing from the wound ceased immediately. Some lint was placed over the wound, supported by a thin flannel roller lightly applied. On the second day after tying the vessel I saw him again. He was much better, the wound looked healthy, and everything seemed to promise well, as the circulation in the anterior and posterior tibial arteries was fully re-established. All went on well till the 21st September, when I was sent for in the afternoon, as bleeding from the leg had again occurred. I found the patient recovered somewhat from the first effects of loss of blood, which had not been to a large amount; but I felt I could no longer persevere in attempts to save the limb, as any farther bleeding might have proved fatal, since the deep part of the wound was still sloughy, a portion of the necrosed fibula close to the knee had still to separate, and the patient was exceedingly debilitated from the previous exhausting disease, as well as from the haemorrhage.

rhage. It was decided to amputate the limb at the lower part of the thigh. I had foreseen that this usually simple operation would be complicated in this case, both on account of the greater number of vessels which would require ligation in consequence of the enlargement of the collateral branches after ligation of the femoral, but especially from risk to the deligated artery itself, by any traction exercised on it during the operation, as it was about the period when the ligation begins to separate by ulceration, and accordingly I had obtained the assistance of my friends Dr. Handyside and Dr. Littlejohn. Dr. Hislop administered chloroform, and as soon as the patient was under its influence he was carefully turned round and drawn towards the edge of the bed, and the limb steadily supported.

Dr. Handyside having compressed the common femoral, I removed the limb by double flap above the knee. The mouth of the superficial femoral was readily recognised, but I first secured the enlarged collateral branches, which could not be so completely commanded by compression. Before tying the superficial femoral, Dr. Handyside, at my request, relaxed the compression somewhat, and blood flowed from its mouth, but, as might be expected, not in a jet. It was then tied: the flaps were approximated by sutures, and the stump was dressed. There was little blood lost during the amputation, but the patient was very weak, and it was some time before he fully rallied under the use of stimuli, and he required careful watching during the night to prevent the circulation flagging; indeed Dr. Littlejohn and I watched him constantly. Towards morning reaction became fairly established, and he took some food; an opiate was given him, which procured him some refreshing sleep. I returned to town, but took the precaution of leaving my senior apprentice, Mr. Rhind, in constant charge, in case of accident, till the femoral ligation came away, as Dr. Hislop of course was often engaged with cases at a distance. At first the stump healed very rapidly, except where the ligatures hung out. The ligation of the superficial femoral separated on the fifteenth day from the time it was applied, or about eight days after the amputation. Subsequently the patient suffered from irritation of the bowels, and one or two attacks of general erythema supervened, beginning on the face, and spreading over the trunk and stump, but gradually, under the use of the tincture of the muriate of iron, and attention to diet, his general health began to amend, and then the stump healed well. Last summer he was in perfect health, and able to walk considerable distances, and still continues, he says, in better health than for many years before his illness.

Dissection of the Limb.—I carefully examined the amputated limb the morning after the operation. I found all the textures covered and matted together with firmly consolidated lymph, so that, on removing the gastrocnemius and soleus muscles, no trace could be seen or felt of the posterior tibial vessels and nerve, or of the fibular artery. To avoid all risk of accidental lesion of these vessels during dissection, I cleared the popliteal artery; and being unprovided with a syringe, I passed a long probe gently downwards, so as to guide me in the direction of the vessels. By very careful dissection I cleared the upper part of the posterior tibial artery, and in doing this I came upon a soft and sloughy portion of lymph, which readily broke down under the handle of the scalpel, and proved to be part of the cyst of a small abscess or cavity, about the size of a large filbert, containing pus and grumous blood, in which a portion of the fibular artery lay insulated, and of a dirty green colour. I withdrew the probe from the posterior tibial artery, and passed it gently into the fibular. There was no opening on the posterior surface of the vessel, or that towards the wound. I therefore made an inci-

sion and removed a considerable portion of the vessels and surrounding soft parts, so as to be able to examine it more carefully afterwards. On doing so I found the vessel immediately above and below the small cyst or abscess encrusted (if I may use the term) with firmly adherent lymph. This lymph was continuous with that which formed the walls of the abscess, and opened anteriorly by an irregular ulcerated orifice. On enlarging this opening, so as to expose the anterior surface of the peroneal artery, and, on injecting water from the popliteal, a hair-like stream was seen to issue from the forepart of the fibular artery. I then removed the whole anterior portion of the cyst, and found the peroneal artery perforated by a minute ulcerated opening, large enough to admit a bristle. The coats of the vessel, however, were soft, thin, and of a greenish colour, and completely insulated for about an inch, whilst beyond the insulated part the tunics of the vessel were inseparably incorporated with the lymph, so as to defy all attempts to clear the vessel by dissection. Some small necrosed portions of the fibula still remained attached at its upper part of that bone.

Remarks.—The principal point of interest in this case is the complication caused by the occurrence of hæmorrhage from the ulceration of the fibular artery, in consequence of its being isolated by the suppuration around it. At the same time, to form a correct view of the treatment adopted, it is necessary to keep in mind all the circumstances of the case; for the previous debilitated state of the patient, from the long-continued irritative fever, the subsequent profuse discharge, hectic, and general exhaustion, together with the disorganised and altered condition of the structures of the affected part of the limb, were all complications requiring to be carefully considered in deciding on the measures to be adopted when the secondary hæmorrhage occurred.

I have said that I suspected that the bleeding might come from the fibular artery, from the relative position of that vessel to the diseased bone and the unhealthy suppuration around. Hence my first object was to try and secure the vessel directly at the bleeding point. But, on examining the exposed surface, which the extensive incision in the leg readily admitted of, there was no jet of blood or other indication to guide me, while the altered condition of the structures in the wound, the matting together of some parts, and the sloughy condition of others, caused me to desist, as I felt that, under such circumstances, without some direct indication of bleeding, a tedious dissection would be required to reach the vessel, with no certainty of reaching it at the open point; and, after all, my surmise as to its being the fibular artery might be wrong. Again, if an opening in the vessel were found, its coats might be so unhealthy as not to hold a ligature above and below the opening. The subsequent dissection of the limb proved the difficulties of direct ligature to be even greater than I had anticipated. The portion of the vessel where the opening existed was surrounded by an encysted abscess, and had only bled indirectly into the wound; hence the reason that no jet could be observed on removing the pressure on the femoral when examining the wound. The arterial tunics, where they were isolated, were so soft and sloughy that they would not have held a ligature for a few hours, if at all; whilst immediately beyond the isolation the whole track of the vessel was so

incorporated with adherent lymph as even to defy its separation to any extent, by careful dissection, when removed from the limb. What probability, then, would there have been of treating the vessel by direct ligature?

As to the method of indirectly controlling the bleeding, by weakening the general circulation through the limb, by ligature of the superficial femoral, no one can be more impressed than myself with its uncertainty, as compared with direct ligature, owing to the free anastomoses in the thigh and around the knee, above the bleeding point. But when, for the reasons above stated, the latter could not be adopted, I considered it right to give the patient that chance rather than amputate, as I had seen it succeed in cases of a similar character. I had likewise, by somewhat similar means, successfully arrested hæmorrhage from ulceration of the brachial from sloughing, after a severe burn, by tying the third portion of the axillary artery. It is true that in that instance I at the same time applied ligatures above and below the wound of the brachial; but these ligatures separated by ulceration on the fifth day, so that, except for the ligature of the axillary artery controlling the circulation, bleeding would have recurred. Hence I felt warranted in trying it in this case; and, indeed, there was little room for hesitation, for the patient was so sunk from the recent bleeding, as to out immediate amputation out of the question; and as oozing was still going on and direct pressure had failed, something required to be done.

There can be no doubt, I think, as to the generally admitted propriety of giving preference to direct ligature above and below the opening in all cases of wounded arteries, as a great general rule, and it is one which can scarcely be too much insisted on; but at the same time we must keep in mind that there are exceptions to this, as to all our general rules, and that much must depend upon the state of the vessel opened. If its coats are diseased and sloughy, if their vitality and that of the surrounding parts be impaired, as after extensive unhealthy suppuration or severe burns, then direct ligature, if trusted to alone, without controlling the force of the circulation by ligature on a healthy point of the vessel higher up, must often prove abortive, and repeated hæmorrhage from rapid ulceration of the deligated part of the artery be the result. In fact, everything depends upon the state of the arterial tissue in the neighbourhood of the lesion, and the probable destructive power of the agency producing it. I have instanced burns by fire; on the other hand, ulceration from caustics generally leaves the parts whence the slough has separated healthy, and, curiously enough, the very patient whose case I have just narrated nearly lost his life on a previous occasion from ulceration of the radial, caused by nitrate of silver applied to a bite. On that occasion I also saw him, but knowing the limited action of the caustic, I exposed and tied the radial above and below the ulcerated point with success. But it would have been a very different matter in the sloughy condition of the fibular in the present instance, even if there had been any indication to guide me to the bleeding point. In the present case the ligature of the femoral did effectually prevent all hæmorrhage for a time: .

it allowed the patient time to rally ; and when, on the circulation being fully established, the bleeding recurred, it was both less active and less in amount, and, had the patient been even tolerably strong, I doubt not but that moderate and regulated pressure might have ultimately succeeded in arresting further hæmorrhage. But debilitated as he was by the previous exhausting disease and the repeated bleeding, and peculiarly depressed by the fear of hæmorrhage from a remembrance of the risk he formerly ran, I felt that even a very trifling loss of blood might prove fatal, and the danger to life seemed so great as to forbid any further attempts to save the limb.

CLINICAL CASES

ILLUSTRATIVE OF THE TREATMENT OF ANEURISM.

CASE OF SUBCLAVIAN ANEURISM, IN WHICH THE ARM WAS AMPUTATED AT THE SHOULDER-JOINT.

On the 22d of March 1864, Mr. F. T., engineer on board H.M.S. ——— was placed under my care on account of aneurism of the right subclavian.

He informed me that about the beginning of 1860 he was under the necessity of doing some hard work with large heavy hammers. After his exertions he was much troubled with pains in his right shoulder, which were considered rheumatic, and treated as such in a hospital, to which he was confined for five weeks.

The pains were then so severe that he could not move the arm from the side, without suffering the greatest torture. He recovered to a great extent, but never was able to use his arm at all freely, without experiencing pain shooting down the arm and round the shoulder.

These pains were often present when the arm was at rest, and there were exacerbations at frequent intervals.

Six months before I saw him, the arm began to feel cold and numb, and the ring and little fingers became insensible ; in which state they continued until his admission. Fourteen days before he came to me, he for the first time became aware of the existence of a swelling at the root of the right side of the neck. On examining him I found a pulsating tumour commencing in the interval between the two heads of the sterno-mastoid, extending outwards, and occupying the whole subclavian space ; there was also more pulsation than usual below the clavicle.

The right radial pulse was almost imperceptible, the right arm cold, numb, and somewhat œdematous ; the hand was purple and mottled ; the veins of the arm, shoulder, and right side of the neck were engorged.

Shooting pains were almost constantly felt in the arm. A distinct aneurismal *bruit* was heard over the tumour with the aid of the stethoscope. No further appreciable disease could be detected in the heart or great blood-vessels. The lungs were healthy, with the exception of a liability to frequent but slight attacks of catarrh. His general health had, however, been somewhat impaired by service on the west coast of Africa. Tongue was slightly furred. Appetite pretty good. Bowels regular. Pulse 72, of very fair strength in the healthy arm. Urine normal. His complexion was sallow and bilious-looking.

I had him placed in a private ward, and directed the limb to be wrapped up in cotton wadding, and supported in a sling ; and ordered him occasional doses of rhubarb and potash, with citrate of magnesia.

The cotton wadding raised the temperature of the arm several degrees, but the pain, though it abated when the patient was kept at rest, frequently recurred in severe paroxysms.

After careful consideration and consultation, I decided on amputating the arm at the shoulder-joint, and with that view had him kept quiet in bed for several days previous to the operation, which I performed on April 6.—Cutting from without inwards, I dissected a large flap, comprising the greater part of the deltoid, and then disarticulated, bringing the knife out so as to divide the remaining soft parts, thereby allowing the main artery to be compressed before its division, as the circulation through the subclavian could not be commanded. The enlarged anastomosing branches bled very freely. After securing all the smaller vessels with ligatures, I cleared the axillary artery, with a view to tie it as near the aneurism as possible; but, on reaching the lower border of the pectoralis minor, I found the vessel dilate so suddenly, and its coats to be so thin, that I deemed it unsafe to clear it further, and therefore tied it at that point. The edges of the wound were brought together with silver sutures, and an opening left for discharge at the lower angle. The patient was then placed in bed, an opiate was administered, and external warmth applied.

During the afternoon and evening there was severe vomiting from the effects of the chloroform, which was very ill borne by him.

Ice, brandy, and soda-water were given, and mustard applied to the epigastrium; in the evening $\frac{1}{2}$ gr. of morphia was given in the form of suppository. *Evening pulse*, 108. *April 7.*—He had very little sleep during the night, owing to the vomiting which continued at intervals during the night and following day. Pulse 120, rather weak. To have $\frac{1}{2}$ a gr. of morphia in a suppository, and 3 oz. of wine daily. *April 8.*—Vomiting ceased. Slept very badly; copious discharge from stump. Tumour in neck is not more than half the size which it was previous to the operation. Pulse 124. Opium pill at bedtime, with two Colocynth and Hyoscyamus pills, to be followed by an enema in the morning, as the bowels have not been moved for three days. *April 9.*—Slept pretty well. Tongue furred; pulse 100; bowels freely moved; a little erythema at the lower edge of the wound; two stitches removed.—To have white of egg and milk as a drink. *April 10.*—Slept well; pulse 98, of improved strength; cramps frequently felt, which were referred to the lost arm; more stitches removed, and hot fomentations applied to the stump. A large opiate at bedtime, on account of great pain in the stump. *April 11.*—Pain abated. The tumour is now so small that it cannot be seen, and the feeling of pulsation is much diminished; wound looking well; more stitches removed. *April 14.*—All stitches removed; there is a little bagging under the short flap, but the discharge has free vent; pulse 85; tongue slightly furred; appetite-improving. *April 17.*—Doing well; stump looks healthy. *April 18.*—Tongue rather dry in the centre; pulse 82; complains of great pain and numbness in the stump; discharge copious and healthy; wound dressed with chlorinated soda lotion. A small counter-opening was made in the short flap, and a considerable quantity of pus evacuated. *April 20* (14th day).—Two ligatures separated; discharge from stump moderate and healthy; pulse 82, of fair strength. *April 21.*—Three ligatures separated; no hæmorrhage. *April 24.*—Another ligature separated; rather more pulsation is now perceptible in the tumour; general health excellent; wound healthy; dressed with a lotion containing sulphate of zinc.

From this date the amputation wound continued to go on favourably; the ligature on the axillary artery separated on the 7th May, and the rest of

the wound was nearly healed. The aneurism was very much decreased, it was, indeed, scarcely perceptible to the eye, though, on examination, the sac could be felt flaccid, and having very little pulsation; but it did not feel as if consolidation by coagulation was taking place. His recovery was delayed by repeated attacks of bilious diarrhoea, which I at the time attributed to some hepatic affection contracted in warm climates, but which, I afterwards learned, arose from his own irregularities.

He was allowed to get up on the 18th of June. On the 24th of June the report is:—"Since he left his bed the aneurism has perceptibly increased in size. Compression of the aneurism was begun to-day by means of a pad of lint placed over it, and secured by three long straps of plaster.

"*June 30.*—The pressure has produced no inconvenience. The aneurism is considerably smaller. His health is good. The stump looks well; only one sinus now remains to be healed.

"*July 5.*—Ordered 5 grs. of iodide of potassium thrice a day, to be gradually increased to 20 grs. thrice daily. Compression still maintained.

"*July 20.*—He now takes 12 grs. of the iodide thrice a day. Yesterday he was troubled with coryza-headache and abdominal pain, in consequence of which the iodide has been stopped for a few days. The tumour is decidedly smaller and harder.

"*July 23.*—Iodide resumed in 12 gr. doses, as the symptoms of iodism have disappeared. General health good.

"*July 30.*—He now sits up nearly the whole day. Compression has been steadily maintained without producing the slightest inconvenience. The aneurism is very decidedly smaller and harder. He is taking 14 grs. of iodide thrice a day without producing bad symptoms, and he is in excellent health and spirits."

Mr. T. left Edinburgh shortly after this—having received his discharge from the service—and went to reside in one of the midland towns in England. I heard from him occasionally, and for about two years the accounts were favourable as to the aneurism in the subclavian region, but it never altogether disappeared. Disease of the vessels nearer the heart seemed to have supervened, and he died in the course of last autumn (1868). I could learn no particulars of his death, and I suspect that it was not a little accelerated by his own irregularities.

Remarks.—The points to which I would first direct attention in this case are the characters of the aneurism, and the general condition of the patient.

The position and extent of the swelling have been already noted. It was clearly an aneurism involving the middle and external thirds of the subclavian, and somewhat also the terminal part of the first portion; and, from the strong pulsation at the upper part of the axillary region, though covered by the thick and powerful pectoral, I suspected that the first part of the axillary was affected. As to its general characters, careful examination satisfied me that it was one of those elongated, ovoid or fusiform dilatations of the vessel arising from an alteration affecting the contractile and resilient functions of the middle coat, and allowing of gradual dilatation and alteration of all the coats. As we very generally find in such cases, there was no hardness or other symptom of coagulation; the swelling was compressible, and it gave a peculiar feel to the compressing finger, as if a flaccid vessel with thick-

ened coats was pressed upon. Now, in cases of aneurismal dilatation of this form, from the integrity of the internal tunic, there seems less tendency for the molecules of the blood to adhere to the sides of the sac, whilst the circulating fluid, rushing with equal force in all directions, acts more generally as a disturbing force, than in cases where we have ulceration of the two inner coats, with lateral dilatation of the fibro-cellular tunic. Hence the aneurism in this case was not very favourable for any treatment in which we had to trust principally to coagulation; indeed the absence of this natural tendency to a cure is unfavourable to any plan.

The state of the patient's general health was not very promising. Although a powerful, muscular man, he had long been in service in an unhealthy climate, and had suffered from rheumatism, remittent fever, and hepatic derangement, whilst the nature of his profession as engineer in one of H.M. ships, together with concomitant circumstances, had rendered the state of his general health by no means favourable for an operation.

I now come to the consideration of the circumstances which determined me to make a trial of Sir William Fergusson's proposal.

The methods whose respective merits, or rather demerits, I had to consider were—1st, The Hunterian plan, by tying either the innominate or the first part of the subclavian. 2d, The direct ligature, by dissection towards the innominate, so as to enable an assistant to command the circulation through it, and then to open the aneurism, and tie the orifices entering the sac: the modification of the old method of operating recently revived in some cases of axillary and inguinal aneurism. 3d, The Distal or Brasdor's method. And lastly, the method I adopted.—In regard to the first of these alternatives, the ligature of the innominate, or first portion of the subclavian artery, has proved so uniformly fatal, even in favourable circumstances, that I could not venture to entertain any hope of success in my case.

Direct ligature by opening the sac, and tying the artery on each side of the aneurism, as has been done in some axillary and iliac aneurisms by Mr. Syme, was suggested. The circumstances in this case, however, were very different. In the case of axillary aneurisms, the circulation can be effectually controlled during the operation; but here, laying bare the innominate so as to allow an assistant to compress it between his finger and thumb, would have only imperfectly effected the object, it would not have controlled the reflux vertebral circulation into the sac; and even supposing the circulation controlled, the proximal ligature must have been placed on that portion of the subclavian where all its large branches arise, and consequently with almost a certainty of failure of the hæmostatic process. Moreover, the fusiform character of the aneurism was unfavourable to the chance of a healthy portion of artery being found on either side of the dilatation. The direct method, therefore, seemed to me quite inapplicable to a subclavian aneurism such as this. I was therefore almost shut up either to try Brasdor's method of tying the artery on the distal side of the sac, or to combine that with removal of the stimulus to vascular supply, by performing amputation at the shoulder. In this case I felt less difficulty in deciding on amputation, inasmuch as the state of the arm rendered

gangrene imminent, both from interrupted circulation and venous engorgement; it therefore seemed probable that further interruption by tying the innominate, or ligature of the axillary by Brasdor's method, would lead to complete gangrene, and necessitate amputation. The plan proposed by Sir William Fergusson seemed to me to give the fairest chance of a cure, and although it involved mutilation, the case was one of life or death, and of immediate urgency, to say nothing of the state of the arm already referred to. The principle of the method is obvious. We not only secure all the benefits likely to arise from Brasdor's plan, but the removal of the upper extremity, to which the circulation, through the subclavian, is principally directed, removes the attractive force of the tissue to be supplied—the *vis a fronte*, as it has been termed. The function of the affected vessel is arrested, and the circulation, no longer required in that direction, will be thrown upon other vessels. The force of the blood being thus removed from the diseased vessel, and its function being abrogated, I trusted that gradual diminution of the sac, and coagulation within it, would lead to obliteration and cure of the aneurism. In many respects these hopes were realised. The marked diminution, almost effacement of the tumour, which immediately followed the operation, showed, I think, that the force of the circulation through the subclavian was very decidedly lessened, and I think it probable, had it been a saccular aneurism, that coagulation and complete cure would have followed. In this fusiform aneurism, however, all that resulted for some time was flaccidity of the dilated portion, and this permitted re-distension when the circulation became stronger. Ultimately, considerable hardness from coagulation did take place, and the aneurism, though not cured, became small in size, and somewhat consolidated.

There were also peculiar circumstances in this case, unfavourable to the desired result. I intended tying the axillary very high up, and accordingly, after securing its cut end, I dissected it upwards; but a little above the lower border of the lesser pectoral muscle, the vessel dilated so suddenly and looked so thin in its coats that I did not venture to tie it up higher than that point. The ligature was higher than the origin of the subscapular, but still a greater number of branches were left between the aneurism and the ligature than I could have wished. Another cause to which I attribute failure was, that owing to the patient's previous habits stimulants were necessitated from the first, and, as can be easily understood, excited the circulation, and so interfered with the cure. I believe, from the state of the aneurism when he left Edinburgh, that, had the patient given himself a fair chance, the result might have been more favourable. As it was, whilst the case cannot be considered a cure, the operation was so far successful as to show the correctness of the principle, and to warrant employment of the plan in any similar case. It certainly prolonged life beyond the time that the ligature of the innominate would have been likely to do. Were I to perform this operation again, I would begin by tying the axillary in its upper third, if healthy, so as to command the circulation, and restrain the terrible hemorrhage from the dilated collateral vessels.

POPLITEAL ANEURISM.

J. F., iron-moulder, æt. 43, admitted 13th December 1858, stated that about fourteen days previously he first noticed a beating sensation, somewhat painful, in the popliteal space of the leg. At first he paid little attention to it, but as the pain and pulsation steadily increased, he applied at length to the Dispensary, whence he was remitted to the Royal Infirmary on the above date.

On admission, the tumour was about the size of a small orange, and pulsating powerfully. At first the limb was simply placed in the flexed position, and the patient put on small diet and low allowance of fluids. Afterwards compression was superadded, together with the exhibition of small doses of antimony, and this method of treatment continued till the 4th January 1859, without any effect, however, in arresting the progress of the disease. Accordingly, on the 5th January the femoral was tied, but owing to the diseased state of the heart and great vessels no chloroform was administered. Pulse 120. Ordered an opiate.

For a few days after the operation the patient complained of pain in leg and foot, and slept little; but on the 10th the restlessness and pain had diminished and the pulse sank to 95.

On the 27th the ligature came away, and everything was looking well, until 8.30 A.M. the following morning, when hæmorrhage broke out at the point of ligature. About two ounces were lost before the tourniquet could be applied; and at 11.30 P.M. same evening, and 3 A.M. next morning, about an ounce of blood escaped in all. Ordered wine and an opiate.

30th.—Slept well; less nervous. Pulse 99.

In the early part of the month of February the patient suffered a good deal from rheumatic pains in various parts of the body, and as the exhibition of opiates was almost imperative, the bowels became somewhat costive. Ordered a powder composed of Chlor. Hydrarg. and Pulv. Rhei ãã gr. v. At this time, also, the diet was gradually increased, and on the 17th he was placed on full allowance.

March 12th.—Wound healed. Patient still complains of pain about the ankles and toes, although it is much less severe.

After the above date nothing worthy of remark occurred, and on the 9th May he was dismissed cured.

RECURRENCE OF POPLITEAL ANEURISM AFTER LIGATURE OF SUPERFICIAL FEMORAL; TREATMENT BY COMPRESSION UNSUCCESSFUL. CURED BY FLEXED POSITION OF LEG.

T. H., coal-carter. This patient was first admitted into my wards in May 1857, on account of a popliteal aneurism, which he had only noticed about four weeks previously to his applying for advice. The tumour was then about the size of an orange, its contents fluid, and it pulsed strongly and equally over its whole extent. For some days the patient was kept at perfect rest and on low diet, but the tumour increased so rapidly, and became so tense, that I considered it necessary to tie the superficial femoral without further delay. This was done, and everything went on most favourably. The tumour became flaccid, and ceased to pulsate, and the only cause of anxiety was the low temperature of the foot and leg. The incision healed

by the first intention, with the exception of the point where the ligature hung out. The thread separated on the twenty-ninth day after the operation. About the period when the ligature separated, slight undulatory pulsation could be perceived in the tumour, which was much diminished in size ; but as this not unfrequently occurs, I did not pay much attention to it, until the pulsation became gradually more and more powerful ; but even then I was deterred from using any great amount of compression, owing to the low vitality of the foot and the absence of pulsation in the tibial arteries. After a time, however, by bandaging the limb, and cautious compression of the femoral, and direct compression by a compress of lint over the aneurism, the swelling gradually diminished, and the pulsation was reduced to a line corresponding to the course of the artery, and not larger than the popliteal of the opposite limb. After leaving hospital the patient returned to his usual avocations and habits, occasionally showing himself at the Infirmary. In August 1858 he returned to hospital, and said the swelling had suddenly increased within two or three days. On examination I found the tumour to be as large, and pulsating as violently, as before the artery had been tied. On consultation with my colleagues compression was determined on, and a carefully conducted and extended trial of this plan of treatment was given, at first with some promise of success. It was persevered in for upwards of five months, when it was discontinued, as the tumour again began to increase instead of diminish. The patient left the house for some weeks, but returned, desiring to submit to any operation that might be thought necessary. On examining the aneurism at this time its condition was as follows:—It was the size of a pretty large orange, and pulsating strongly ; the femoral artery could be felt to pulsate for about four inches below Poupart's ligament, ceasing to beat about an inch or less above the point where the superficial femoral had been tied. Pressure on common femoral completely and readily arrested pulsation in the sac. Compression of the superficial femoral above the point tied also did so, but required very firm pressure to be made directly backwards. Compression along the course of the superficial femoral, below the point tied, produced no effect until it was made over the lowest part of Hunter's canal, when the pulsation of the aneurism became thoroughly commanded by it. Under these circumstances, after weighing the comparative chances of success between ligature of the external iliac, or the lower part of the superficial femoral, the latter plan was decided on, and the patient willingly gave his consent. But as the case did not seem a very hopeful one it was thought as well to try the plan of flexion of the leg upon the thigh. On bending the leg fully, all pulsation was at once and completely arrested, and the limb was bandaged in that position. But the patient could not bear such flexion to be kept up ; accordingly, a slipper, with a bandage sewed to the heel, was fastened on the foot, and the slip of bandage was then fastened to a loop connected with a broad bandage round his pelvis, and this gradually tightened so as to increase daily the flexion of the leg on the thigh. This treatment was commenced on the 20th of May 1859. On the 23d the pulsations were weaker, but returned when flexion of the limb was discontinued. On the 27th the pulsation diminished ; tumour smaller and firmer. There was still a tendency to increase of pulsation when the limb was allowed to remain straight for any length of time. On the 6th of June the pulsation was scarcely to be felt in the aneurism, even when flexion was discontinued. The tumour felt solid and smaller, and enlarged anastomosing vessels could be felt over it and round the knee. The patient was now allowed to walk about with crutches, the affected limb being suspended in a flexed position.

When in bed, or sitting in the ward, he was desired to extend the leg occasionally, and not to keep it constantly bent. On the 23d of June there was not the slightest pulsation to be felt in the aneurism, which was firm, and considerably diminished in bulk. Several very large anastomosing vessels could be felt over the tumour, the limb was of good heat, and there was no stiffness of the knee-joint. I kept the patient for about three weeks longer in hospital under observation, and he was dismissed cured.

Since then he has returned to his usual occupation of a coal-carter, which requires him to walk considerable distances; but when I last saw him, two years after the operation, there was no tendency to return of the disease.

Remarks.—Those two cases of aneurism present some features of interest. In J. F.'s case the arterial system seemed very generally affected, and there was evidence of valvular disease of the heart. When the common femoral was compressed so as to control the circulation, the course of the superficial femoral could be readily traced for some distance, the rigid state of its coats maintaining the form of the vessel even when empty. The condition of the patient was therefore by no means favourable; and from the rigid feel of the artery, I felt apprehensive lest its coats might give way under the small round ligature. Still, the rapid increase of the tumour necessitated the operation to give the patient a chance of life, as it was evident that otherwise the aneurism would soon have given way. I therefore tied the superficial femoral rather lower down than usual, and was well pleased to find its coats perfectly healthy at the part exposed.

As regards the compression, and the other treatment adopted in the first instance, these were had recourse to for the purpose of affording time for a certain amount of coagulum to form in the sac, and not with any prospect of curing the disease, as the unhealthy state of the iliac and common femoral arteries contra-indicated even very moderate direct compression. The bent position employed must not be confounded with the plan adopted in H.'s case. In this case merely slight flexion over a double-inclined plane of pillows was used, so as somewhat to diminish the direct force of the blood into the aneurism.

The secondary hæmorrhage which occurred seems to me difficult to explain. The ligature did not separate till the twenty-third day after the operation, when the incision had closed except where the thread projected, and there had never been the slightest indication of bleeding either at the decidence of the ligature or previously. The hæmorrhage, which did not occur till twenty-four hours after the ligature came away, seems to have resulted from incautious exertion of the patient; and when all compresses and dressings were removed no active bleeding recurred. I have seen bleeding take place at earlier periods after ligature, and not recur; but I do not recollect any instance of the kind in which bleeding came on at so late a date as this, without any premonitory symptoms. Shortly after the bleeding the parts around the wound looked turgid and brawny, but there was no apparent engorgement of the parts antecedent to or at the time of the hæmorrhage. It seems difficult to believe that it could have proceeded from the deligated point of the artery; for, though the thread had only come away the previous day, it must have separated, and the hæmorrhagic

process caused by it must have been completed some days before ; and if from that source the bleeding would hardly have been stayed so readily. In my experiments on the ligature of arteries, I have seen two instances in dogs, where, from partial breaking up of the plastic effusion and displacement of the clot, hæmorrhage occurred, and stopped spontaneously ; but it took place in both cases about the tenth day, and resulted from the animals struggling violently with other dogs. From the statement as to the quantity of blood lost, however, it seems in this case either to have proceeded from the superficial femoral itself, or from ulceration of some dilated branch. I have seen the patient several times since he left the hospital ; and when I last saw him he had improved very much in his general health, so as to give me hope that his life may be prolonged for several years, whilst there is scarcely a trace of hardness or swelling at the site of the aneurism—a result satisfactory, as vindicating the operation under such very unfavourable conditions.¹

In H.'s case I attribute the recurrence of the aneurismal condition to the fact that the operation of tying the superficial femoral was performed while the sac was large and its contents so entirely fluid as to admit of the free retrograde circulation into its cavity through the articular branches arising from the diseased part of the vessel. I believe that one condition favourable to success is, that there should be a certain amount of coagulation within the sac before ligature, so as to obstruct or diminish the more direct anastomoses into its cavity, and thereby get rid of a disturbing force and favour consolidation. But in this case I was compelled to operate early during the fluid state, on account of the rapid increase in size of the aneurism, and its threatening to become diffuse. The recurrence of pulsation after it had been so much diminished by pressure and rest, and the sudden enlargement of the aneurismal tumour after remaining quiet so many months (I had seen the man only a week before, and there was then no perceptible change from the state in which he left the hospital), are circumstances not easily explicable. As to the collateral vessel, which seems to have been the principal cause of restoring or keeping up the aneurismal state, I think the effects of compression of the femoral at different parts of its course prove that it must have been the *anastomotica magna*.

In considering the question of a secondary operation when compression failed, the choice was limited to ligature of the external iliac, or of the lower part of the superficial femoral. Under all the circumstances, the former seemed unfavourable, as in all probability the anastomosing branches would be so much enlarged after ligature of the femoral, that the circulation would speedily be restored in the aneurism through the inosculations of the internal iliac with the profunda. Or if, on the contrary, these inosculations were not enlarged, then the risk of gangrene of the limb would be very great ; and, had it occurred, amputation, if admissible at all, must have been performed very high up in the thigh or at the hip. Whilst, on the other hand, the ligature of the superficial femoral low down, in Hunter's canal had only one grave

¹ He died suddenly three years after the operation

objection, that of being near the diseased part. Fortunately, the simpler plan of flexion of the limb prevented the necessity for any operation, and, from what I saw of that plan in this case, I would have great hopes of its success as a curative measure,—far simpler and more efficacious than any form of compression I have seen employed, devoid of all its risks, and not interfering with, but rather beneficial as a preparation for, ligature of the artery, should it fail itself in accomplishing a cure.

POPLITEAL ANEURISM TREATED BY FLEXION. ACCIDENTAL RUPTURE OF ANEURISM AFTER IT APPEARED CONSOLIDATED.

A. N., æt. 36, was admitted on July the 8th, 1862, with an aneurism occupying the lower part of the popliteal space, which, judging from the patient's statements, had probably existed for four months. The patient also suffered from extensive cardiac disease, having a double aortic and a mitral regurgitant murmur, with hypertrophy, especially of the left ventricle. There was general visibility of the pulses, and the radials were slightly corded. Treatment by flexion was adopted, the limb being gently flexed both at the knee and hip joints, and placed on its outer side on an air-pillow. This position was maintained by a strap stretching from the heel of a slipper to a figure-of-eight bandage passed round the thigh and abdomen; while perfect rest was enjoined, with a nourishing but non-stimulant diet. A certain degree of pain, which at first attended this treatment, passed off, and the case seemed to be progressing most favourably, as the tumour had become much smaller and harder, and the articular arteries were distinctly enlarged around the knee. Suddenly, however, on the morning of the 18th August, the patient experienced a sensation as if something had given way behind the knee-joint, and immediately complained of intense pain in the limb. On examination, it was evident that the aneurism had ruptured; and, accordingly, manual pressure was applied over the femoral artery to prevent further extravasation of blood. After consultation it was determined to tie the femoral artery, which was accordingly done, the limb being wrapped up in wadding immediately after the operation. On the 16th of August, being the seventh day after the rupture of the aneurism and ligature of the femoral, gangrene of the limb having set in, amputation at the lower third of the thigh was performed by the long anterior flap.

Remarks.—The propriety of tying the femoral artery may be questioned, but by arresting the circulation it afforded a reasonable hope that the rent in the sac might become occluded, and the extravasated blood, which was not very large in amount, absorbed; while, even if gangrene did supervene, amputation could be performed before the attending constitutional symptoms had developed themselves.

CASE OF FUSIFORM POPLITEAL ANEURISM, CURED BY LIGATURE OF FEMORAL ARTERY, AFTER FLEXION AND COMPRESSION HAD FAILED.

Adam B., æt. 39, a customs-house officer, was recommended to my care by Dr. Struthers of Leith, on account of a peculiar form of popliteal aneurism.

The patient stated that his attention had been first directed to the part by pain of a dull aching character, and on putting his hand on it he felt the strong beating, and thereupon consulted Dr. Struthers, who directed him to keep the limb perfectly quiet. After keeping him under observation for a few days Dr. Struthers sent him to me. This was in April 1866. The swelling in the popliteal space had not the ordinary distinct form of popliteal aneurism, but felt like an enormously dilated artery, becoming smaller above and below. Its contents were quite fluid, and could be easily repressed into the circulation; and when this was done, or when the sac was rendered flaccid by compressing the femoral artery in the groin, the swelling filled again rapidly on pressure being removed. The patient seemed otherwise in good health. The heart's action was normal. The femoral arteries at the groin were not firmer or larger than natural, either in the affected or the sound limb, whilst the radial, ulnar, and brachial arteries were also healthy. He complained chiefly of cramps in the affected leg, and stated that the size and pulsation of the swelling had been increasing of late. The posterior saphena and popliteal veins of that limb were somewhat more dilated than those of the sound limb.

On considering the circumstances of the case, I determined to try the treatment by flexion, combined with graduated compression of the femoral artery in Hunter's canal. With this view I had him kept in bed, and the leg was gradually flexed on the thigh, and the thigh on the pelvis, till he was able to bear the greatest degree of flexion. At the same time, by means of Signorini's tourniquet, compression was made on the femoral in the situation of the upper part of Hunter's canal; and this also was gradually increased in force until he was able to bear complete obstruction of the circulation for very considerable periods. As he was a very intelligent man, and perfectly understood the principle and object of the treatment, he was instructed how to relax and tighten the instrument, and to note the effect produced. At the end of five weeks the size and pulsatory force of the tumour were so much diminished as little to exceed those of the healthy vessel; but there was no appearance of solidification or obliteration of the vessel at the affected part. I therefore recommended the treatment to be continued. This was done for three months, when, as the pulsation and size of the vessel felt nearly natural, he was allowed to walk a little, at times resting the limb in the flexed position. At first all seemed to go on satisfactorily, but gradually the vessel dilated, and the pulsation returned in force. Again the treatment by flexion and compression was tried, compression being made both at the groin and also over the artery in Hunter's canal. So long as he remained quiet this treatment produced diminution of the aneurismal swelling, but never seemed to cause any consolidation, the sac apparently being merely rendered flaccid. The patient's health was beginning to suffer from the long confinement, and he was therefore allowed to get up and go out occasionally; and as the swelling soon resumed its original size, and indeed increased in bulk, he determined to submit to the operation of ligature of the femoral.

With this view he entered the Royal Infirmary on the 16th November 1866; and as at that time his general health seemed much deranged, I fortunately determined to wait for a week before operating. In the course of four days the symptoms of typhus fever manifested themselves, and he left the hospital for his own home. He made a good recovery from the fever, and returned to my wards in the Infirmary on the 18th of January 1867, much improved in health, but the aneurism considerably increased in size.

On the 23d January I tied the femoral artery at the lower part of Scarpa's

triangle. The operation was very easily accomplished, as there was scarcely any oozing of blood. The coats of the femoral were beautifully healthy, and the aneurism needle very easily passed without disturbance of the parts. The only thing noticeable was the great depth of the vessel from the surface, owing to a large amount of fat, both superficial to the sartorius and between the fascia and the sheath of the vessels, a condition remarkable in a patient so recently recovered from typhus fever.

The wound was dressed in the usual manner. Nothing of importance occurred in the after progress of the case. The ligature separated on the 11th of February, and he was dismissed cured on the 6th of March 1867. When I last heard of him he continued in perfect health, and free from any aneurismal disease.

Remarks.—In accordance with the views, and for the reasons I have stated in my Lectures, I believe that the fusiform or ovoid aneurisms arising, as they do, from dilatation of all the coats of the artery, are less favourable for curative treatment of any kind than the lateral or sacculated aneurism, as the tendency to coagulation is much less. The reasons which induced me to give so prolonged a trial to flexion and compression in B.'s case were—1st, Because I was afraid that, as the aneurismal portion contained no coagulum, the free inosculations of the branches of the profunda femoris, with the articular and other branches arising from the dilated popliteal, would almost directly restore the circulation in the aneurismal portion immediately after ligature of the superficial femoral, and so prevent a cure. 2dly, Because I trusted that, if I did not accomplish a cure by the flexion combined with compression, this treatment would at least conduce to some coagulation or deposit of fibrine taking place within the aneurism, and so prepare for the ligature of the artery being attended with a greater chance of success. The combination of compression with the flexion method obviated the risk of any accidental rupture of the aneurism occurring, as in the case of A. N.

CASE OF FUSIFORM ANEURISM OF THE FEMORAL ARTERY

CURED BY COMPRESSION.

R. J., seaman, aged 32, admitted into Hospital January 12, 1871, suffering from a fusiform aneurism of the left femoral artery at its lower part.

On examination, a pulsating tumour is felt in the lower part of Hunter's canal, a little above the point where the anastomotica magna comes off from the superficial femoral. A little fulness, but no projecting swelling, is seen externally. The aneurism when defined is about two inches long by one and a half broad, and spindle-shaped.

History.—The patient first felt pain ten days before admission. He is a seaman on board the *Pharos*, and having to walk daily from North Leith to his ship, he noticed that his leg became painful, making him walk lame before reaching the ship. He thought at first that the pain was rheumatic; but as it continued he applied to Dr. McBain, R.N., who sent him into the Infirmary.

Patient says that firm pressure over the tumour causes the pain to cease, but when this is removed the pain at once returns and remains, unless pressure again be made.

January 15.—On examination, Mr. Spence decided on treating the aneurism by compression. Patient ordered to take the following medicines:—*R. Potass. bromid. ℥jv., aquæ ad ℥vj.*—a tablespoonful every evening; and *R. Potass. iod. ℥ij., aquæ ad ℥vj.*—a tablespoonful thrice daily.

16th.—Dr. Watson's "pressure apparatus" was applied to-day over the common femoral (the skin being previously dusted with fine fuller's earth), the weight being so directed as to press upon the common femoral just as it comes out of the pelvis in the upper part of Scarpa's triangle. The weight caused great pain; but the patient was able to bear it, and the circulation through the artery was completely arrested. During the night and day the weight was taken off at intervals. The pulsation became less and less, and ceased in the evening.

18th.—Weight taken off at twelve o'clock to-day, and no pulsation felt.

19th.—To-night, at twelve o'clock, the weight was replaced, as Mr. Spence thought he felt slight pulsation; and it was kept on continuously till the hour of the visit at noon the next day.

20th.—No pulsation. The limb is flexed, a pillow being placed under the knee, which is turned out. Patient told to compress the artery with his thumb, so as to weaken the flow of blood to the thigh. Not only is the knee bent, but the femur is likewise flexed on the pelvis, thus weakening the force of the blood by making a curve in the artery. Ice to be applied over the seat of the aneurism.

27th.—Slight pulsation felt at intervals, and ice kept on constantly.

February 2.—Ice taken off. Patient said that about five o'clock in the morning, when he awoke, there was great itching and irritation over the aneurism; but now (12 noon) all pain had disappeared.

(On *January 26* a lighter form of compression—Hoey's compressor—was put on, and a piece of sponge was placed between the pad and the skin to ease the pain.)

February 3.—The light-pressure apparatus was again put on for a short time.

9th.—The patient allowed ale or porter, but any change of pulse to be carefully watched. No thrill felt to-day. The ice has been discontinued since *February 2*.

March 2.—The patient left to-day cured.

May, 1872.—He has been back once or twice complaining of slight pain; but there is no return of the aneurism. He was advised not to take much exertion, and to avoid straining the limb in any way. I have seen the patient recently, and there is no return of the aneurism.

Remarks on the Case of R. J.—The points of interest in this case are—1st, The nature of the aneurism; 2d, The special conditions of the portion of the femoral artery affected; and 3d, The success obtained by the method of treatment adopted. As to the nature of the aneurism: Fusiform aneurisms, formed by dilatation or all the arterial tunics, are admittedly less favourable for the process of cure than lateral sacculated aneurisms, because of the less tendency to the formation of coagulum within the dilatation. The internal coat for some time retains its smooth character, and the current of blood through the vessel sweeps with equal force in all directions, and thus prevents or delays the process of obstruction at the diseased part; hence this variety of aneurism is not favourable for treatment either by ligature

or compression. The chances of firm obstruction by a consolidated clot being small, the risk is that the retrograde circulation may gradually re-establish the aneurism after ligature, whilst, if compression be resorted to, the dilated part of the vessel may again become distended by the direct current after the compression is removed. The only condition favourable to coagulation in such an aneurism is that which Sir Charles Bell long ago pointed out—viz. that whenever the coats of an artery, owing to irritation or disease, lose their power of reacting on the blood current, that fluid tends to coagulate, as it would in an organic tube, and thus the diseased part will ultimately become obstructed unless the disturbing force of the direct current of blood prevents this taking place. Fusiform aneurism is not common in the lower extremity. I have only met with one instance of it in the popliteal artery (the case of Adam B., already detailed), and in that case graduated compression fairly persisted in for upwards of six months failed to effect a cure. I then tied the femoral with complete success. Having the result of that case before me, it may be asked what decided me on treating this case by compression in preference to ligature. My decision resulted from a consideration of the peculiar conditions of the part of the femoral in which the disease was situated. The oblong aneurism was in that part of the femoral immediately above the origin of the great anastomotic artery, and as the contents of the dilated portion were quite fluid, such a direct retrograde feeder would have speedily refilled the vessel, and acted as a disturbing element in preventing the formation of a coagulum. Indeed, I determined that, if compression failed, I would cut down upon the vessel in Hunter's canal, place ligatures above and below the dilated part, and tie the anastomotic at the same time, as I considered that ligature by the Hunterian method would not effect a cure under such circumstances. The successful result in this case I believe to be due to the method of compression used. From what I have observed of gradual and graduated compression in my own practice or that of others, I have not been favourably impressed by it. Indeed, I have stated elsewhere as my opinion—"I believe that our success will depend on how far we are able to arrest completely the circulation through the femoral." The compression apparatus of my colleague, Dr. Watson, seemed to me well suited to obstruct thoroughly the circulation through the artery; whilst, from its form and mode of action, the patient would be able to bear the pressure for a sufficient length of time to allow permanent changes to take place in the aneurism. In this case the compression required to be reapplied, in consequence of some doubtful symptoms of returning pulsation, and the compression was assisted by dry cold applied over the aneurism. But these precautionary measures, and also the prolonged rest, were used from a consideration of the character of the fusiform aneurism, to guard against tendency to recurrence of the circulation through the dilated part of the vessel, and to allow time for its obliteration. The result fully justified the opinion I had formed as to the method of treatment.

CASE OF FEMORAL ANEURISM SUCCESSFULLY TREATED BY LIGATURE
OF THE FEMORAL ARTERY IN SCARPA'S TRIANGLE.

W. W., æt. 32, labourer, admitted *January 4, 1865*. About four months ago patient observed on the inner aspect of his right thigh a firm, throbbing swelling, of the size of a walnut. Origin spontaneous, and increase gradual. On admission, an aneurism as large as a small apple was found at the upper entrance of Hunter's canal. On compressing the femoral artery, pulsation ceased, but the tumour could not be completely emptied of its contents. Ordered rest, and milk diet.

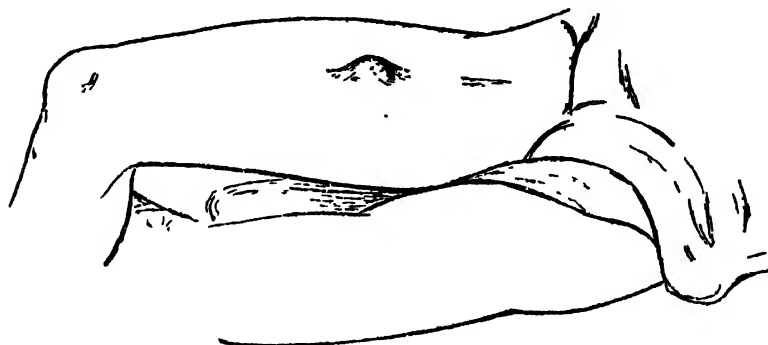


Fig. 151.

Jan. 10.—Professor Spence tied the superficial femoral artery in Scarpa's triangle, which produced immediate cessation of pulsation. The limb was kept slightly flexed, and enveloped in wadding. Convalescence progressed interruptedly, and the ligature separated on the tenth day after the operation. Patient dismissed cured, after having been two months in hospital; the tumour was hard, painless, and not larger than half a walnut.

The femoral aneurism is a form not commonly met with. According to Dr. Crisp, "of 551 cases of aneurism, 157 affected the popliteal, and only 66 the femoral artery; and of these 66 only 21 were truly femoral or femoro-popliteal." This may be accounted for by the exposed position of the artery in Scarpa's triangle, and in the popliteal space, allowing for expansion at these points; while, in the intermediate part, the vessel is surrounded by muscles and aponeurosis. The most frequently employed modes of treating such cases are compression, or ligature of the superficial femoral or external iliac arteries. The former of these methods is uncertain and tedious, while the latter is attended with great success. In the case of W. W., not a single bad symptom followed the operation, and a very small amount of suppuration served to cause separation of the ligature. On his being dismissed from hospital the tumour was firm, painless, and less than half its original size. The patient walked about without experiencing any inconvenience; and when heard of, about six months later, he was able to work as formerly, and the tumour continued to diminish.

TRAUMATIC VARICOSE FEMORAL ANEURISM SUCCESSFULLY
TREATED BY DOUBLE LIGATURE.

On Thursday, 26th March 1868, I was requested by Mr. Miller, surgeon, Rankeillor Street, to visit Robert K——, a youth who had received a wound in the thigh about three weeks previously. Accordingly, I met Mr. Miller and Dr. Littlejohn in consultation. Mr. Miller, who had been called to the lad immediately after the injury, gave me the following account:—

“I was hastily called by the police to the shop of Mr. Prentice, druggist, 126 Nicolson Street, on the afternoon of Wednesday, 4th inst. (March 1868) to see Robert K——, aged fifteen years, of Graham Street, who had been stabbed with a spear-pointed knife by a schoolfellow. Supported by a man he had walked from Buccleuch Street, and had fainted by the way from loss of blood. I found him lying on two chairs, very pale and faint, in consequence of profuse hæmorrhage issuing from a wound in the upper and anterior aspect of the right thigh. The wound, which extended obliquely upwards, was about three-quarters of an inch in length, and one inch and a half in depth. After stopping the hæmorrhage and dressing the wound, I had him conveyed home in a cab. He progressed very favourably, and in ten days the wound had entirely healed, though the patient still continued weak. Perfect rest was still enjoined, but after a few days he could not be restrained from going out and walking about, though rendered lame by slight pain, and stiffness of the tendons at the back of the limb, which, however, improved every day. He called on me on Monday, 23d inst., and stated that he had been to Leith on the previous Friday, that he had walked hurriedly home from the station, and for the first time felt ‘a beating’ in the part, but no pain. On examination, a little above the wound, I found a pulsating tumour, which I diagnosed as a false aneurism. He was ordered home, and enjoined perfect rest and quietness.”

I found the patient a lad of slender form, and tall for his age, of delicate appearance, and somewhat anæmic. On examining the right thigh, I observed a cicatrix, as of a recent punctured wound, situated on the outer border of the sartorius muscle, five inches and eight lines below the middle of Poupart's ligament. Extending from the puncture there was a pulsating swelling, not very prominent, somewhat flattened, of an elongated oval form, two and a half inches long, by one and three quarter inches broad. About two inches of the swelling were on the proximal side of the wound, *i.e.* towards Poupart's ligament, and about half-an-inch on the distal side. Besides this distinct pulsating tumour, there was also an undefined fulness on the inside of thigh, close up to Poupart's ligament, caused by the dilated femoral vein, and the upper part of internal saphena was also dilated. The aneurismal swelling at the wound was seen to pulsate, and the pulsation was very strong when the hand was placed on the tumour, and accompanied by a most peculiar thrill, almost startling when first felt. On using the stethoscope, besides the “blowing” sound, there was also heard a loud buzzing or whizzing *bruit*, which has been not inaptly compared to the noise made by a “blue-bottle fly confined in a paper bag.” This latter sound was so loud as to be heard even at a little distance, and without the stethoscope. The thrill and whizzing murmur extended upwards from the wound both in the aneurismal tumour, and in the dilated femoral vein nearly as high as Poupart's ligament, but they were much less distinct in the lower part of the aneurism—only barely appreciable. The pulsations of the anterior and posterior tibial arteries seemed rather weaker than in the sound leg. The patient felt the

limb somewhat cold, but the thermometer showed no difference in the actual temperature.

I directed that he should be kept perfectly quiet in bed, with the thigh flexed on the pelvis, and that graduated compression should be maintained upon the common femoral artery, at the brim of the pubes, where it emerges from the abdomen, by Carte's compressor, modified so that the pressure was made by means of a leaden weight instead of the full screw action. He was ordered to have a nutrient, non-stimulating diet, consisting of milk, with white of eggs, and farinaceous and a little animal food. Under this treatment the pulsations and bulk of the aneurism diminished, but I found that the compression, though as far as possible limited to the artery, interfered with the venous circulation, and gave rise to so much pain and swelling in the thigh, and irritation of the inguinal glands, that it was obliged to be abandoned. Ice was then applied over the swelling and to the groin, and was beneficial in allaying the irritation resulting from the compression, but it had little effect on the aneurism; and I therefore determined to operate so soon as the local irritation was subdued. I had from the first contemplated the probability of an operation being required, and had carefully weighed in my mind what method of procedure I should adopt, and had decided, for reasons which I shall explain hereafter, to tie the superficial femoral above and below the aneurism without opening the sac. Accordingly, on the 8th of April 1868, assisted by Drs. Dunsmure, Gillespie, Littlejohn, Taylor, and Mr. Miller, I proceeded to perform the operation I had planned. The patient being put under the influence of chloroform, I made an incision $7\frac{1}{2}$ inches long, commencing about 2 inches below the middle of Poupart's ligament, and continuing downwards in the course of the femoral artery. This incision passed over the long axis of the aneurism, and crossed the course of the sartorius muscle, so that I might reach the artery under the inner border of that muscle at the upper part, and under its outer margin at the lower part of the thigh. In making my incision I was careful to cut lightly over the tumour, so as not to divide more than the skin and fat. I next proceeded to clear the artery in the lower part of Scarpa's triangle. In doing so I found the parts more matted together and thickened, and the depth increased from the plastic and serous effusion to a much greater extent than the external appearances would have led me to expect. I required to take great care in clearing and drawing aside the inner edge of the sartorius, which, instead of being loosely connected as usual, was adherent. The sheath of the artery, however, was not so affected, and was readily recognised and carefully opened, and the artery cleared for passing the aneurism-needle. The vein, much distended, was felt bulging under the artery. The armed needle was then carefully passed round the vessel, the ligature left *untied*, and the ends held by an assistant. I next proceeded to tie the femoral below the aneurism in Hunter's canal. The fascia over the outer edge of the sartorius was freely divided, and the edge of the muscle cleared. Here a difficulty occurred, not from adhesion of the margin of the muscle at the part cleared, but owing to the body of the muscle over the aneurism being blended with the tumour, and forming part of the false sac. I found I could not turn over the muscle or draw it aside, so as to expose the aponeurosis covering the artery, without using such force as would have endangered breaking up the limitation of the aneurism. I had, however, foreseen this difficulty, and accordingly, as I wished to tie the artery as close as I could to the aneurismal tumour, I divided about half the breadth of the sartorius, so as to expose and reach the vessel, which here lay very deeply, the depth being increased by the proximity of the tumour.

When I had passed this ligature I tied it firmly, and then proceeded to tie the upper ligature, which had also been applied as closely as possible to the swelling. So soon as the upper ligature was tightened, all pulsation and sound ceased, and the appearance of tumour was almost effaced. The long wound was then closed by points of suture, a slip of dry lint placed over it, and retained by slips of adhesive plaster; the foot, leg, and knee were wrapped in cotton wadding, and the patient placed in bed, with the knee very slightly bent, and laid on its outside on a soft pillow.

When the patient recovered from the chloroform he was a little sick, and vomited. An opiate was administered. The milk and farinaceous diet were ordered to be continued. He progressed very favourably, and the wound healed well, little treatment having been required, except medicine and enemata to act on the bowels—which were very constipated—so as to prevent straining at stool. No marked alteration in the temperature of the limb occurred after the first two days. On the twelfth day after the operation, the lower ligature came away when I was dressing the wound, and without any appearance of blood. Slightly stimulating lotions were used to wash the points of the wound which had not cicatrised, and support was given by strips of adhesive plaster. On the 25th of April I had to leave for London, and I visited him on that day (the eighteenth after the operation). He was looking well and cheerful; pulse 86, and soft, and his tongue clean. The wound looked well—in fact, except where the upper ligature hung out, and at one or two other points, it had united; and I considered him almost, if not altogether, out of danger. I left Dr. Dunsmure, who took charge of my cases, to look after him as regarded the surgical treatment. From that gentleman I received a letter, informing me of a somewhat unexpected and sudden change in the progress of the case:—

“You left on Saturday the 25th. On Sunday I got a note saying that after straining at stool, four drachms of blood had come from the incision. On visiting him I found no trace of hæmorrhage at either of the ligatures, but the wound had opened over the sac, and a clot of blood was lying in it; his pulse was quick, 120, and his skin hot. Mr. Miller had ordered him acouite, which made him sick. All that I did was to enjoin quiet, and cold to the wound; and, as his tongue was loaded, I ordered him a blue and compound rhubarb pill. On Friday, when I saw him with Mr. Miller, he looked more than usually pale, and his pulse was still quick, but the skin and tongue were better. He had had pain in the right side, and some cough, both of which were relieved by a poultice. I ordered him a better diet, wine (claret), and iron, and to-day his pulse is 96; the wound’s almost healed, the part over the sac is healthy, and I have no fear of him. I took hold of the ligature, but it is not yet sufficiently loose to come away.”

After this the bad symptoms seem to have disappeared, and, on my return to Edinburgh on the 11th May, I found him looking very well, the wound healed, except at the ligature, which I found was lying loose, and I therefore removed it. From this time nothing worthy of record occurred. He was allowed to walk at first with a crutch, and subsequently to use the limb. He was lame for some time owing to the stiffness of the knee, but this gradually disappeared, and he now uses the leg perfectly. For some time after the operation I directed him to use a flannel roller to support the venous circulation in the limb. The cicatrix was narrow and firm; not the slightest pulsation or *bruit* to be felt or heard, no appreciable venous congestion, and his general health excellent.

To-day (10th June 1869) I examined Mr. K——. As already stated,

the aneurism is thoroughly cured ; not the slightest pulsation or thrill can be felt ; but the appearance of the limb indicates some obstruction or alteration in the venous circulation of the part. The right thigh is greater in circumference by one inch than the left. The swelling is neither tense nor cedematous, but soft and elastic. The cicatrix is thinner and broader than it was eight months ago ; whilst towards the groin numerous small superficial veins are seen dilated and slightly tortuous ; but the common femoral and great saphena veins, which were distended and varicose before the operation, seem now of their normal size.

Remarks.—Numerous observations have been recorded in reference to the pathology and treatment of varicose aneurisms, but, with few exceptions, these have been cases in which the disease was situated at the bend of the arm, and in most of them the operative procedure has been the same as that for ordinary false aneurism in the same position—namely, laying open the sac and tying the wounded artery above and below the opening ; and in some of the cases ligature of the affected vein has also been practised.

In one or two cases the brachial at the middle of the arm has been tied, but not with results that encourage repetition of the Hunterian method. Indeed, in the upper extremity the ligature of the wounded brachial artery above and below the opening, and gentle compression of the injured vein, answers sufficiently well, and the operation is not likely to be attended with bad results. It is, however, very different with regard to such aneurisms in the femoral region.

All surgical authorities are agreed as to the great danger which attends obstruction of the femoral artery when complicated with any lesion of the accompanying vein, gangrene being the almost invariable result. So much have the risks of such a complication influenced practice, that even in cases of ordinary traumatic false aneurism of the femoral in the position of Hunter's canal, an exception has been made to the general rule of operating in false aneurism by direct incision into the sac. Thus, in cases where the traumatic aneurism is of some standing, and the parts condensed, it is considered better, in the case of the femoral artery, to tie the vessel by the Hunterian method in Scarpa's triangle, lest, from the close proximity of the vein, and the condensation and matting of the wounded parts, the latter vessel might be injured in operating by the direct method ; and Professor Syme and others have recorded cases showing the success of such treatment.

In considering what method of operation I should follow in the case of K——, I could find but little information in surgical works as to the treatment of traumatic varicose aneurism of the femoral, either as regarded general principles or the results of actual practice. As I have already said, most of the observations of Hunter, Park, Hodgson, Breschet, Sabatier, and Dupuytren, had reference to varicose aneurism at the bend of the arm, and the general rule laid down, as drawn from such cases, was to open the sac and tie the vessel as in false aneurism—a rule repeated, I see, in the last edition of Professor Erichsen's *Surgery*, as applicable to varicose aneurisms generally.

The only author who differs from this practice is the late Mr. Lizars,

who, speaking of this form of aneurism at the elbow, advises tying the artery above and below the wounded point, without opening the sac. His reason is, the risk of phlebitis, if we interfere with the vein; and I recollect seeing him perform this operation in a small varicose aneurism of the brachial in the Royal Infirmary. At the bend of the arm, however, the results of the ordinary operation have shown that the risk Mr. Lizars dreaded was so slight that his plan has not been generally followed.

In looking to the history of cases of this aneurism in the thigh, I could find very few cases recorded, still fewer where any operation had been performed. Several of the cases which had done well without treatment were evidently cases of aneurismal varix, and not of varicose aneurism. It is essential to remember, in reference to treatment, that whatever symptoms these two diseases may have in common, such as the peculiar *bruit*, the state of the veins in the affected limb, or the constitutional effects consequent on admixture of venous with arterial blood, they differ in this important feature, that in aneurismal varix we have the vein and artery closely adherent and communicating directly, and that, although both vessels undergo dilatation and some alteration in structure and function, there is no aneurismal tumour involving the risks incident to all aneurisms, and consequently in it all that is generally required is moderate support to the venous circulation by bandages or elastic or laced stockings. In varicose aneurism, on the contrary, the false sac, which communicates with both vein and artery, has a constant tendency to increase, burst, and diffuse its contents into the limb, or else lead to ulceration of the skin and fatal hæmorrhage.

The records of traumatic varicose aneurism of the femoral or popliteal are very meagre. I can find only two cases detailed, and one doubtfully alluded to by Sabatier. Both the detailed cases were in the popliteal artery. One case occurred under M. Larrey, Director of the Military Medical School at Toulouse, and uncle of Baron Larrey. In that case amputation was performed. In the other case, under the care of Dr. Dorsey of Philadelphia, the disease followed a gunshot wound. The femoral artery was tied in the middle of the thigh, and hæmorrhage supervened and destroyed the patient. Mr. Hodgson, in his *Work on The Bloodvessels*, suggests that ligature of the femoral in Scarpa's triangle would be the proper plan of treatment. The diminution of the force of the blood after the ligature, he thinks, would favour the formation of a coagulum, which would finish by filling up the sac, and obliterate its opening of communication with the vein; but he adds, "I do not think, however, that any one has yet tried this operation."

Since operating on the lad K——, I have learned from Mr. Paget that Mr. Lawrence operated by Hunter's method in a case of varicose aneurism of the thigh; but gangrene came on, amputation was found to be necessary, and the patient died. There is a brief notice of the case in the Catalogue of the Museum of St. Bartholomew's Hospital, vol. ii., Description of Casts: but there are no details given.

In deciding on the method I should adopt, when I found that compression could not be continued with any hope of success, it appeared to me that I could scarcely trust to ligature of the superficial femoral

in Scarpa's triangle; for, though I believe that to be the safest procedure in certain cases of simple traumatic aneurism in the thigh, the conditions are very different in the varicose. In a simple traumatic aneurism of the femoral artery in the middle region of the thigh, where some time has elapsed after the injury, the dense aponeurotic structures, confining the wounded vessel and extravasated blood in a narrow space, assisted by the condensation of the surrounding cellular tissue resulting from plastic effusion, serve to form an amount of limitation and circumscription almost equal to the sac of a true aneurism, and to favour consolidation of the blood clot; so that, when the force of the direct blood-current is shut off, gradual consolidation and obliteration take place, as in cases of true aneurism. In traumatic varicose or arterio-venous aneurism, on the other hand, whilst we may have similar limitation as regards the surrounding parts, we must keep in mind that through the interior of the sac there is a communication, more or less free, with the large femoral vein; so that the retrograde current of blood will meet with no resistance in that direction. Complete consolidation of the contents of the sac could scarcely be looked for, and as the collateral circulation enlarged, the retrograde current would become stronger, and in all probability the diseased condition would be re-established.

The plan generally adopted in varicose aneurisms at the bend of the arm I have already indicated as being inapplicable in the thigh; for, if surgeons avoid operating in the usual manner for ordinary traumatic aneurisms of the femoral, from dread of injury to the vein, what is only a risk in that case becomes a certainty in varicose aneurism; because in it the artery and vein already communicate in the sac; opening the sac, therefore, implies more or less interference with the vein, and would be followed by the usual bad results. Careful consideration of these circumstances induced me to adopt the plan of tying the femoral artery above and below the sac, in such a manner as to avoid opening or injuring it, by the operative procedure which I have described in the case. By doing so, I trusted that all retrograde arterial circulation would be obviated, that coagulation of the contents of the sac would take place, and that the wound of the vein communicating with the sac would thus be closed, and the venous circulation restored to its natural channel. So far as the artery is concerned, my expectations have been fulfilled, and the aneurism is thoroughly cured; but judging from the present appearance of the limb, some slight obstruction to the venous circulation would seem to exist, and though not productive of any inconvenience at present, will require to be remedied by the use of an elastic stocking to support the returning column of blood, and so avoid any tendency to varix.

From a full consideration of the general principles on which the method of operating which I have described is founded, as well as from the successful result of the case narrated, I feel satisfied that it is the proper mode of procedure in cases of varicose aneurism.

In closing, I would merely advert to the sudden and unexpected invasion of peculiar and serious constitutional symptoms so late as the nineteenth day. I do not pretend to speak decidedly, but my first

impression, when I received Dr. Dunsmure's letter, was that some small detached portion of the contents of the sac had found its way into the vein, and given rise to thrombosis, although the favourable termination of the symptoms scarcely warrants that idea; and possibly it was mere febrile disturbance, due to some irregularity in diet.

LIGATURE OF EXTERNAL ILIAC ARTERY FOR INGUINAL ANEURISM.

Mr. C. H., aged 32, first consulted me at my own house on the 31st October 1879. About six months previously he had felt uneasiness and noticed a small swelling in the left groin, but as he had recently had a chancre, he thought it was a swollen gland, and did not apply for medical advice until a few days before he consulted me. His medical attendant recognising the nature of the case sent him to me. On examination, I found a pulsating tumour the size of an orange projecting the abdominal parietes, in the situation of the external inguinal ring, and partly projecting through the aperture; but continuous with this there was felt a large and more flattened swelling of a somewhat firmer character, occupying the left iliac fossa as high as the level of the anterior superior spine of the ilium, and passing even a little higher where it approached the mesial line. This part of the swelling also pulsated distinctly, though not so forcibly as the projecting swelling at the ring, where the contents were distinctly fluid, the projection becoming quite tense at each pulsation, as if it would burst.

I advised him to have an operation performed as soon as possible, and dissuaded him from returning home to the north of England in his present condition. He, however, returned home the same afternoon, to consult with his friends. The swelling, as might have been expected, was not improved by this proceeding, and by the urgent advice of his medical attendants he returned to my care on Tuesday, the 4th November. Even in the few days that elapsed the tumour had increased, especially the projecting portion, and seemed as if it would burst from the tension and violence of pulsation. It was late in the afternoon when he arrived, and appearances were so urgent that I decided to operate the next day. I therefore placed him in a private ward in my department of the Royal Infirmary. The remainder of the case is taken from the Hospital Journal.

"C. H., aged 32.

"Admitted November 4, 1879.

"On the 5th November, in the large theatre, Mr. Spence performed the operation of ligature of the external iliac.* The portion of the tumour which projected was about the size of a large orange; careful examination showed its extent to be much larger. It extended from Poupart's ligament to the level of the ant. sup. spine of the ilium. On account of the peculiar position of the aneurism, the incision could not be made in the usual position for ligature, and it was necessary to operate at a higher level, in order to enable the operator to place the ligature either on the common or external iliac, as might be necessary. The special difficulties of this case were—the great development of the subcutaneous fat and muscular textures, rendering the incision unusually deep; the adhesion of the peritoneum to the upper part of the sac. When the external iliac artery was reached it was found that only the lower portion of the artery was diseased, and that the aneurism overlapped the upper part on account of its size. A ligature of carbolised silk was now applied to the external iliac itself, and not, as was half expected, on the com-

mon iliac. The immediate result of this was a cessation of pulsation, and marked decrease of tension in the tumour.

"Strict antiseptics were employed. At first everything progressed favourably. The projection at the external ring had visibly diminished immediately on the vessel being tied, and, except a slight thrill felt on the second day after the operation, pulsation could never be felt in any part of the swelling, and the upper part of the aneurism seemed to diminish rapidly. There always remained, however, a point in the tumour where consolidation had evidently not occurred. The ligature separated on the 21st of November, without the slightest appearance of blood. The superficial wound healed rather slowly, owing to the quantity of fat giving rise to a sort of greasy discharge.

"From this date until the 17th of December everything went on favourably; the wound gradually contracting, and the patient considered out of danger. On that day he began to complain of a pain in the contracting tumour shooting down the leg.

"On the 21st December, about 8 A.M., the patient, whilst suffering from a sudden attack of intense pain in the tumour and leg, gave it a jerk. Bleeding came on suddenly from the small unclosed part of the incision, and patient lost a considerable amount of blood. Prof. Spence was sent for, and, when the patient was under chloroform, he inserted his finger into the wound, and found it entered the sac, which was distended with semi-fluid blood. The sac was laid open, and the bleeding, which came in rather a large stream, was checked by the insertion of a No. 10 bougie. The femoral artery was then cut down upon and ligatured, but without checking the bleeding, which appeared to come from an equally large vessel, probably the profunda. This was also secured, and a small vein near where it joined the femoral vein. Nothing worthy of note followed this operation till the 28th December, when about 2.25 P.M. oozing, apparently venous, began smartly; but upon cold and pressure being applied it stopped. Prof. Spence was at once sent for, and the patient being put under the influence of ether, the femoral vein was ligatured. The patient was so weak, however, that he never rallied, but died a few minutes after the operation was completed, without having regained consciousness.

Remarks.—The case of Mr. C. H. possesses several points of interest in reference to Inguinal Aneurisms. It is an excellent example of the conditions mentioned at pages 365 and 546, viz. that from its loose connections in some cases of aneurism of the lower part of external iliac, the tumour displaces the upper part of the vessel, curving it on itself, or overlapping it, as was the case here, and thus might mislead as to the extent of healthy artery between the aneurism and the common iliac. Being prepared for this from what I had seen in other cases, whilst I was forced to place my incision higher than usual, I determined not to tie the common iliac until I had satisfied myself as to the condition of the external, and this I readily did even in this deep wound. I found the external iliac perfectly healthy throughout the greatest part of its length, and placed the ligature at a considerable distance below the bifurcation of the common iliac, and the obliteration of that vessel for some distance on each side of the ligature was perfectly accomplished. On the distal side it is seen as an impervious cord down to the position of the sac.

In this case the great depth of the vessel, owing to the deposit of fat and strong muscles of the abdominal walls, together with the bulk of the viscera within the peritoneal sac and the overlapping of the vessel by the sac, would have rendered the passing of a ligature round the vessel difficult; but I had prepared for this by having a Deschamp's needle ready, and on the ordinary needle being handed me I saw it would be useless, but, taking the Deschamp's needle, I passed it without the slightest difficulty, the vessel having been previously cleared for ligature.

The most important point, however, is the cause of the bleeding from the sac at so late a period after the ligature, and when up to a day or so before it occurred all seemed safe, and the great bulk of the tumour much diminished, and, except at one point, apparently solid, and no pulsation to be felt at any part of it. What was the source of the bleeding? From the length of time since the ligature had separated without a tinge of blood I felt satisfied it could not be secondary hæmorrhage from the deligated part of the artery, and on breaking up the recent adhesion of the wound, so as to introduce my finger, I at once felt that the bleeding proceeded from a low point in the sac. I accordingly with a probe-pointed bistoury freely enlarged the incision down towards Poupart's ligament, and turned out the clots rapidly; and on this being done there was a gush of blood from a large opening close to the brim of the pelvis, near the position of the femoral vessels, which was at once arrested by the finger of one of the gentlemen assisting me, and then a No. 10 bougie was used to stop it. I then dissected through the textures in the groin upon the common femoral, and passed a ligature round a vessel in that position, to get a healthy portion of artery. On removing the bougie partly from what had been the bleeding orifice, hæmorrhage recommenced. I therefore cleared round the bougie as a guide, and passed a ligature, which was tied as the bougie was withdrawn. This completely arrested the bleeding. Thinking that the flattened cord which I had tied in the position of the common femoral might not be vascular, I cut the ligature; but as this was at once followed by arterial bleeding from another orifice in the sac, I reapplied the ligature, when the bleeding from that source ceased. It is very difficult to judge from the dissection in my possession what were the sources of the original arterial bleeding, as I have not yet been able to finish my dissection of the part; possibly there was a high division of the common femoral. The last hæmorrhage was venous, from unhealthy suppuration around, and ulceration of the femoral vein. From the fact that one point of aneurism, corresponding to external inguinal ring, remained fluid, but without pulsation, I have sometimes asked myself, could there have been any venous complication in this case? Certainly there was none of the peculiar sound so marked in arterio-venous aneurism, nor any varicose state of the superficial veins, usually present in such cases.

Finally, the case has, to my mind, indications as to the treatment of large inguinal aneurisms in the iliac fossa. Were I to meet with a similar case, I would do what I was at first prepared to have done in this case. I would, after placing the ligature under the external or common

iliac, as the state of the artery might require, leave it to an assistant to tighten if required. I would then dissect down on the common femoral, and pass a ligature under it, and tie it; and then, after firmly tying the iliac artery, I would lay open the abdominal parietes, open the sac, and, after turning out the clots and removing as much of the sac as possible, tie any small bleeding points, thoroughly sponge out the part with carbolic lotion, and close the wound. This could be more easily accomplished when the parts were so far in their natural state than when the parts are matted together by the results of a previous operation, and confused by recent hæmorrhage.

LECTURE LXIX.

EXCISION OF JOINTS—History of the Operation— Its Benefits as compared with those of Amputation—The Objects sought to be attained by the Operation—How these are Modified by Circumstances—Considerations for our Guidance in the Selection of suitable Cases for Operation, as regards the Patient, and the Extremity and Articulation affected.

AMONGST the improvements which mark the progress of modern surgery in our day, there is none which, in my opinion, deserves a higher place than EXCISION OF JOINTS as a substitute for amputation. In properly-chosen cases the results are most satisfactory, and the operation is more truly conservative than many methods of treatment which are so called. Whatever difference of opinion may exist as to certain excisions in the lower extremity, all who have witnessed the satisfactory results of excisions in the upper extremity, especially those of the elbow and shoulder-joint, must admit the benefits conferred by these operations when contrasted with those derived from amputation of the limb.

Looking at the question of excision of diseased or injured joints, as seen in the results of modern surgical practice, you may be apt to wonder that such operations had not been had recourse to and become the rule of practice long ago. For excision of diseased joints is not a new operation. To say nothing of indications of complete or partial excisions of joints in ancient writers, we find excisions of joints not only practised by English and French surgeons, but special attention drawn to it by them as a plan of treatment suitable to diseased joints, and as saving a useful limb; whilst the results of their cases, and the arguments they adduce in favour of excision, leave very little to be added in the present day. Thus, in England, excision of the knee was successfully performed by Mr. Park of Liverpool in 1781, and his views on the advantage of excisions in general were published in the form of a letter to Mr. Percival Pott in 1782, and also in the *London Medical Journal* in 1789. Mr. Park also mentions a case in which Mr. Filkin, a surgeon at Northwich, had performed excision in a case of diseased knee complicated by injury in 1762. Excision of the head of the humerus had also been performed by White of Manchester and Mr. Bent. In France Moreau, father and son, practised excision of joints as a general rule, and the younger Moreau published a work on the subject. Notwithstanding all the success which had attended excisions of joints both in England and France, the operation never came into general use; and it is undoubtedly to Mr. Syme that we owe its revival and advancement as a general method in the present day. Mr. Syme's work on *Excision*

of Joints, published in 1831, drew general attention to the subject, and the success which attended his operations induced many surgeons to perform excision of the elbow-joint instead of amputation. Still the general adoption of the method was much less rapid than might have been expected from the success of the operation and the advantages gained by it. This partly arose from some surgeons misunderstanding the objects of the operation—viz. to remove the whole of the articular ends of the bones, and to obtain a movable elbow by means of a false joint. Some placed the limb after excision in rectangular splints, and kept it in the bent position to obtain ankylosis. Still more detrimental to the credit of the operation were the attempts to perform partial excision, such as resection of the olecranon or portions of the condyles of the humerus in diseased joints, which attempts were very generally followed by increased local mischief and grave constitutional disturbance, sometimes terminating fatally or necessitating amputation of the arm secondarily. And then many surgeons, forgetting how long it is before the soft parts in the neighbourhood of a diseased joint regain their healthy character after excision, and how frequently in such cases sinuses form from time to time, took alarm, and not unfrequently performed amputation secondarily, when a little patience and reliance on the curative powers of nature would have saved the limb.

I need not, however, dwell longer on the causes which delayed the general adoption of excision of joints in operative surgery, as it is now recognised as one of the greatest improvements in modern surgery; but I rather draw your attention to the objects which we seek to accomplish in performing excision of a joint, and how these are modified in regard to excisions of particular articulations, or in relation to such operations in the upper and lower limbs, and the constitutional condition of the patient; for a variety of considerations must be carefully kept in view, to enable us to perform these operations intelligently, so as to obtain the best results, and to discriminate between cases suitable for excision, and those in which its performance might, from their unfavourable results, bring undeserved discredit on the operation.

In all cases of excision of diseased joints, the paramount consideration is the complete removal of the diseased parts, for unless we can accomplish this the operation is imperfect, and the result cannot be expected to be successful. The next consideration is to obtain as useful a limb as possible. Here our object, and consequently our mode of procedure, will vary, according as the excision is in the upper or lower limb. In the former, our object is to obtain a movable articulation, to admit of the free use of the arm and forearm. In the lower extremity a movable articulation renders the limb useless as a support, less useful than an artificial limb, and hence our object in such cases is to procure firm ankylosis in the straight position. In all cases our operations for excision should be effected with as little disturbance of parts as is consistent with the thorough removal of diseased structures. Finally, the risks to life, as compared with amputation, require to be considered in certain excisions, whether as depending on the state of the patient's health, predisposition to pulmonary or renal disease especially, or as depending on the dangers incident to particular excisions.

As regards the objects mentioned, all surgeons must admit that we are very differently situated in regard to our power of effecting them in excisions of the upper and lower limbs.

In the former, if we perform the operation intelligently in reference to the objects to be accomplished, we can in general effect these fully, and obtain brilliant results; whilst, in the articulations of the lower extremity, the paramount object,—that of removing all diseased structure,—cannot always be fully accomplished in some, whilst in others we are obliged to sacrifice the mobility of the joint to the necessity of having a sufficient support. I shall therefore first speak of the excisions of the upper extremity, as affording the most perfect examples of this operation.

In performing excision of the articulations of the upper extremity, we wish to remove all disease and to obtain a false articulation, which, under the control of the muscles, will admit of either the natural movements of the joint, or movements so closely resembling them, that the use of the limb is but little impaired.

To effect those objects, we require to plan our incisions so that they may avoid division of muscles or tendons, so far as compatible with the thorough exposure of parts necessary for the complete removal of the diseased structures. With this view our incisions should be parallel to the axis of the limb, or nearly so, to facilitate the after-treatment and permit of passive motion being begun at an early period, even before the union of the wound has taken place; and, above all, that the cicatrices may not interfere with the movements of the joint after the cure is effected; this is specially important in the case of excisions of the elbow, but the principle is applicable to all excisions of the upper extremity. So far as possible, complete transverse division of muscles or tendons should be avoided, by making our section of muscular fibres linear, or more or less oblique, so that the divided fibres may unite more readily and with less loss of power. For example, in dividing the attachment of the triceps in excising the elbow, I divide it freely, from and on either side of the olecranon, by two oblique incisions uniting above at an acute angle so as to form an inverted Λ , instead of cutting it across as is often done. Of course all tendons and muscles attached to and covering the capsular ligament of a joint, as in the shoulder, should be thoroughly divided by a bold incision, so as to enable us to disarticulate easily; and so must all muscles or tendons attached to parts of bone which are to be removed.

In dealing with the diseased textures, all the affected synovial membrane present should be removed, by dissecting it off, or by touching any small patches which are adherent with nitrate of silver, solution of chloride of zinc, or perchloride of iron, or strong tincture of iodine. I generally use the chloride of zinc; and in cases of marked gelatinous degeneration I usually brush the surface of the wound with the solution when the resection is completed. In such cases, where we have diseased tissues, the chloride of zinc seems to produce a more healthy form of action, limiting suppuration, and tending to more rapid consolidation of the parts.

As regards the resection of the bones, all the articular surface

entering into the formation of the joint must be sawn off, to an extent sufficient to remove the disease thoroughly; and in cases where we wish to obtain a movable articulation by the formation of a false joint, we must also remove some healthy bone beyond, so as to prevent the coalescence of the resected bones and anchylosis occurring during the progress of the cure. From what I have observed of excisions of the elbow, I think the full benefits of the excision are often lost in consequence of not removing a sufficient quantity of bone, from the dread of leaving a "flail-like joint," a very rare occurrence indeed. Again, the surgeon is liable to be misled as to the amount of the articular extremities of the bones he has removed, if the mere bulk is looked to, for the excited action has generally caused enlargement of the bones and deposition of new bone around. I make it a rule to judge of the extent to be removed by the anatomical marks of the bones; thus, in the elbow I invariably saw through the condyloid portion of the humerus high up; indeed, if that bone be sawn through its flattened portion immediately above the olecranon and coronoid fossæ, and the ulna divided below the base of the coronoid process, and the radius immediately below its head, there is no fear of a bad result. Whereas, if too little bone be removed, the risk of anchylosis is very considerable, especially in young subjects; and I have noticed this more particularly in cases in which the excision had been performed to remedy anchylosis arising from injuries, where the increased bulk and altered form of the bones are more apt to mislead. In such cases, the removal of bone should be very free.

The only case of loose "flail-like" false joint I have met with in my own practice was in the case of a very debilitated man, in whom, owing to the extent of disease, I was obliged to saw through the humerus at the lower part of the shaft, quite above the condyloid part. It is now several years since the operation was performed, and though consumptive and apparently very weak, he still lives. When the arm hangs at rest it certainly has a very "flail-like" and useless appearance; but when he calls the muscles into action he has complete power over the joint, and can raise and sustain considerable weights—in fact he has very perfect use of the arm and hand. So that even this extreme case shows that a loose joint is not so very disastrous, and not likely to happen in ordinary cases. I have never had to regret removing too much bone in excisions of the elbow, but I can look back on cases in my earlier practice when I could wish I had removed more. Whilst on this subject, I confess that, holding the views I do, I am rather at a loss to understand the principle on which dissecting off the periosteum below the point of section of the bone, and retaining it, is advocated; the object in doing so must be to favour the formation of the new bone, and thus render the risk of anchylosis greater. I can perfectly understand it in cases of resection of the knee, where we desire a firm osseous union, or in the upper extremity in cases where we require to remove an unusually large amount of bone, but I must say I think it objectionable in cases where we desire a movable false joint after excision.

In excisions of the lower extremity, in which, as already explained,

we aim at obtaining a firmly-anchylosed joint, to afford support to the body, and in so far as our objects differ, so must our methods of operation and after-treatment. The complete removal of all diseased tissue is equally imperative as in the excisions of the upper extremity, but here we limit ourselves to the least possible removal of bone compatible with the complete removal of disease. In many cases, after making our section of the condyles of the femur and tibia, we may find that the osseous surface still presents traces of disease, often in the form of parts of cavities containing tubercular-looking matter, or of points where the bone seems unhealthy. If the general surface of the divided bone seems unhealthy, then we require to remove a fresh section, and I think it better to do so then than to remove too large a section of bone at first, from the apprehension of diseased structure, which possibly or probably does not exist. In the cases where the cut surfaces present the remains of cavities, or small parts where the bone seems unhealthy, I consider the use of the gouge, and touching the surface with iodine, perchloride of iron, or chloride of zinc, quite sufficient, without requiring a fresh section, and consequent larger removal of bone. As regards our division of the soft parts, the complete division of muscles or the direction of our incision through the skin is of less consequence than when we want to obtain a movable articulation. Indeed, we often divide the hamstring muscles when the knee has been contracted, either as a preliminary or after resection of the bones, to enable us more easily to bring and retain the osseous surfaces in accurate apposition; whilst, in regard to the line of incision through the integument in the knee-joint excision, I feel satisfied that a slightly convex incision extending transversely from condyle to condyle below the patella is by far the simplest method of operating; the firm cicatrix, in this instance, is itself useful in giving solidity in front of the knee. In cases of excision of the hip and ankle, parts of the incisions must almost always be transverse or curved.

Much has been said and written as to the comparative advantages of excision of the knee-joint over amputation, for disease of that joint. Objections have been made to excision, first, on account of the greater risk to life, and secondly, because of the protracted cure and the nature of the limb preserved by the operation. In regard to the comparative risks to life, I shall have to consider that subject hereafter. At present I shall merely treat of the objections to the results of the operation in the cases where the patient ultimately recovers. It is quite true that the treatment of a patient after excision of the knee-joint is necessarily much more protracted than after amputation of the thigh; for, even supposing the wound to heal completely by the first intention, the limb must still be kept slung for at least seven or eight weeks, to insure solid union, and prevent the risk of bending; and even after the patient is able to move about with crutches, some time must elapse before much weight can with propriety be borne on the limb. In referring to these objections, Mr. Syme, in his *Work on Amputation*, has well observed—"It ought to be recollected, too, that though recovery from amputation of the thigh is usually completed in three or four weeks, it is generally at least as many months before the patient can

the weight of his body on the face of the stump, so as to use it in standing or walking. As to the utility of the limb, we find that it can be employed freely in progressive motion, and all the patients have expressed that they considered themselves extremely fortunate in having recovered their legs such as they were. The advantages of the operation which may be contended for, are, that it preserves the natural support of the body afforded by the bones and joints of the tarsus, metatarsus, and toes, which, by diffusing the effects of force applied at the extremity of the limb, protects both it and the other parts of the body from concussion; and that it obviates the necessity of resting the whole of a patient's weight on the face of a stump, which must be done when amputation is performed above the knee."

Mr. Syme might have stated a longer period as being necessary before a patient should use an artificial limb; after amputation, I think at least eight months should elapse, after the stump was healed, before a support is used. As to the objection that the limb left is little, if at all, more useful than an artificial support, the advantages stated by Mr. Syme are fully corroborated by experience in the cases on which I have myself operated, and the experience of other surgeons. The results, as to the use of the limb and the little lameness observable in walking, have, I confess, surprised me. In one case of a young woman, on whom I operated in 1858, and in whom I removed more than the usual amount of bone, having thought it necessary to remove a second section from the condyles of the femur, I dreaded that the lameness would be very great, and she had a high-heeled boot fitted for the foot of the affected limb. A year afterwards I was astonished to see her at the hospital walking with scarcely a perceptible halt, and she informed me that the high-heeled boot hindered her walking, and, on using an ordinary shoe, she found her ease in movement so much greater that she had thrown aside the high-heeled boot; and this, I may state, has been the experience of all my patients, viz. that they walk best with a shoe or boot similar to that on the healthy foot. In other words, the obliquity of the pelvis, though scarcely noticeable, compensates for the shortening, whilst the movements of the hip and ankle joints compensate for the loss of motion in the knee; so that, in most cases, the limb left after excision of the knee joint is very different from an artificial support, as regards the ease of the patient's progression. But, to take another aspect of this objection,—no surgeon would hesitate to prefer cure by ankylosis in the straight position in a case of diseased knee, to amputation of the limb. Now, that is just the result obtained by excision.

In some cases it would appear that a joint which, after resection, was pretty firmly ankylosed, may gradually, from alteration in the bones, become movable, and form a false joint. I once saw a patient under the care of my colleague, Dr. Gillespie, in whom that gentleman had excised the knee, with a favourable result, three years previously, so that the man returned to his occupation, that of a miner. Eventually, however, his health became impaired, and he had pains in the knee near the wound. The ankylosis gradually gave way, and, in spite of a variety of treatment, he insisted on amputation being performed.

On section of the parts, the condyloid portion of the femur was found atrophied, and its lateral section looks precisely like the bone from a stump of the thigh. A false joint had formed, and the femur worked like a pivot in a corresponding cavity in the head of the tibia. The original section of the femur, in the excision, was made through the upper part of the condyles. Deep in the head of the tibia a tubercular abscess was exposed by the dissection. I believe that the cause of alteration and atrophy was connected with the tendency to disease and the state of the constitution, and that, except for these conditions, amputation would not have been called for.

Such cases must be considered as very exceptional, and as by no means forming a valid objection to excision of the knee, only warning us to be careful in discriminating in our diagnosis what cases admit of thorough removal of the whole disease by resection.

Sir William Fergusson, in his interesting and instructive lectures on the progress of modern surgery, shows the great advantages gained by excision of the knee in successful cases, and his own practice has had great influence in giving excision of the knee its present position as a recognised operation in surgery. In the lectures I have alluded to he advocates its claims very strongly, perhaps rather exaggerates them. For, with all my appreciation of the advantages of the operation in certain cases, I am not insensible to the dangers attending it, and the necessity for discriminating as to the cases in which it should be performed, or to the inconvenience which may occasionally result when the resected joint remains very movable, or when the limb is not developed in proportion to the sound one, so as to be very much shorter. I cannot think that the sketch he gives at page 142 is likely to impress many with the advantage of excision over amputation, and I believe that, if that sketch were contrasted with a patient after amputation fitted with a good artificial limb, the contrast would rather be unfavourable to excision.

In regard to the EXCISION OF THE HIP-JOINT, I think that, looking to the pathology of morbus coxarius, and the extent to which the acetabulum is generally affected at the stage in which we would be warranted in abandoning other curative measures and recommending excision, I doubt whether we could ever be sure of removing the whole diseased structure,—in other words, whether we could effect what I have stated as the paramount object of excision of a joint. It has been said that this resection is analogous to the excision of the shoulder, where we seldom require to remove more than the head and tuberosities of the humerus. The two cases are essentially different in many respects—first, the disease in the shoulder-joint is very generally confined to the head and tuberosities of the humerus, very often commencing in the latter, or in the upper part of the bicipital groove; whilst I cannot recollect of ever having seen a specimen of morbus coxarius where the acetabulum was not affected, and generally to a great extent. But apart from the foregoing considerations, the great practical difference lies in this, that the scapula does not form a part of any of the great cavities of the body, so that we can remove, if necessary, not only the diseased surface of the glenoid cavity, or indeed that cavity entirely,

curved bone-forceps, but even a large portion of the scapula, or the whole bone; whereas in morbus coxarius, the acetabulum, if largely diseased, could not be so dealt with, as it forms a part of the walls of the pelvic cavity. In cases of advanced hip-joint disease, where the carious and dislocated head of the femur is felt bare through some sinus, or in the cavity of an abscess, I should consider it advisable to lay the sinus or abscess freely open, and resect and remove the carious portion of bone; but I cannot see much likelihood of excision of the hip-joint (properly so called) becoming a successful operation. More recent experience has modified my views, as I have obtained very favourable results in some cases before suppuration in the soft parts had begun; in which the disease seemed confined to the capsular ligament and head of the femur. The cases, however, in which we are generally required to operate are those of advanced disease in which there need be little hesitation for interference to get rid of the diseased portions of bone.

EXCISION OF THE ANKLE-JOINT, for disease, is a comparatively rare operation: by proper care and treatment when the disease occurs in young persons, and where it is limited to the joint, a cure by ankylosis can generally be effected. Persons above middle age are rarely the subjects of such disease, and if they were, excisions are not very successful at that period of life; whilst, if any of the tarsal bones, except the upper articular surface of the astragalus, be involved in the disease, I consider amputation at the ankle the more suitable measure. But, though I have had no personal experience in regard to excision of the ankle-joint for disease, I can conceive of some cases where it might be practised with advantage; and from what I know of the case with which the articular surfaces can be removed in compound dislocations of the ankle, without injury to the bloodvessels or tendons round the ankle-joint, I think that, in cases of disease proper for the operation, it might be readily accomplished, without dividing any important structures, so as to leave a very useful limb, preserving the movements of the foot, so that I should be inclined to perform it if I met with a suitable case. Since the former edition of this work I performed excision of the ankle for strumous disease, in a young girl, and with what is spoken of as successful result, as it appeared to be so at the time, but when I saw the child two years after the operation, the tibia and fibula had atrophied, and the joint had become movable. The parents were very gratified at saving the foot, but I think amputation at the ankle would have left a more useful limb.

In regard to partial resections of the foot for removal of diseased bones, except in the case of cario-necrosis of the os calcis, from what I have seen of such resections, and experience of my own cases, I have a very unfavourable opinion of such operations. I have, in some cases, removed one of the cuneiform bones, and also the cuboid, with success; but in most cases these operations are followed by mischief in the neighbouring tarsal articulations and bones, erysipelatous inflammation of the foot sets in, accompanied by irritative fever, and amputation of the foot, or, it may be, of the leg, is ultimately required, if the patient escapes the dangers of irritative fever or pyæmia. I believe that such operations are attended with much greater risk to the patient's life

than the results of even occasional successes warrant us to encounter, and hence I prefer non-interference in such cases, or merely gouging out the carious surface, without meddling with the articular surfaces; or, when interference is imperative, I consider either partial amputation of the foot, or at the ankle, the safer practice—the more so, that in such cases all the tarsal bones are generally predisposed to disease; so that, even in cases where partial excisions have been temporarily successful, the disease often returns in other portions of the tarsus, and amputation has at last to be resorted to.

In these general remarks on excision of joints I have almost entirely referred to the operation as performed for disease. In my Lectures on gunshot wounds I very specially pointed out its advantages as a primary operation, and the great success which had attended its performance by military surgeons. The same results would follow its performance in similar cases in civil practice; but, unfortunately, the compound dislocations, or fractures, met with in civil practice, are attended with so much destruction of soft textures, or so complicated with other severe injuries, as either to forbid the operation, or to leave but little chance of success; but in proper cases, especially in the upper extremity, it ought certainly to be practised in preference to amputation.

Excision of joints is one of the operations in which Esmarch's bloodless method can be used with great advantage, as we are thereby enabled not only to save blood but also to see the parts as in a dissection. In some cases of excision, however, it is necessary to modify it, as described at page 276, to prevent pressing purulent or other septic matters into the textures.

The INSTRUMENTS required for performing excision of joints are—India-rubber bandage and circular compressor or a tourniquet, to prevent bleeding during the operation; strong, sharp-pointed bistouries, for the incisions; a straight bistoury, rounded and blunt at the point, which may be useful in some excisions, such as those at shoulder and hip; a saw with a movable back, and a blade eight inches long and three-quarters of an inch broad, the shifting back being so arranged that it is thrown off during sawing; a chain-saw, Butcher's or bow-saw with exchange blades, or narrow saws of different lengths (Langenbeck's), which are useful in some resections, and are more efficient than the chain-saw; bone-pliers of different sizes and forms; gouge, and gouge forceps; a pair of Sir William Fergusson's lion forceps to grasp detached portions of bone and give lever power; a pair of small necrosis forceps; metallic spatulæ to hold aside and protect the soft tissues during section of the bones; artery forceps; suture needles, and the other instruments needed in all operations. The apparatus for after-treatment consists of cushions or pads of lint, or antiseptic gauze, and different forms of splints, which are chiefly needed in special resections, and will be described when speaking of these. A small quantity of solution of chloride of zinc should be at hand to touch any parts of the diseased synovial membrane, which cannot be dissected off.

LECTURE LXX.

Comparative Mortality following Excision and Amputation in Upper and Lower Limbs as seen from Statistics—Causes of the Mortality exemplified by Illustrative Cases—Instruments and Apparatus required for the Operation and After-treatment of Excision of Joints.

THE question of the comparative mortality in cases of excision of joints and of amputation can, I think, have reference only to these operations in the lower extremity. In the upper extremity a fatal issue after excision is very rare as compared with amputation. As regards my experience in my own practice, when I published the first edition of this work out of 112 cases of excision of the elbow-joint I had lost only 6 cases. In 17 cases of excision at the shoulder-joint I had met with no fatal result; and in 8 cases of excision of the wrist I had met with no fatal case, but in two of these last, amputation of the forearm was required subsequently. Of the 6 fatal cases of excision of the elbow, 2 died of acute pyæmia, 1 of pyæmia complicated with acute albuminuria. In one case, the patient, a young man, died of albuminuria five months after the operation. The symptoms began to develop themselves six weeks after the operation, and the wound of the operation was healed four weeks before death. The fifth fatal case resulted after the only primary excision which I have had an opportunity of performing, and the young man had sustained numerous injuries—namely, cerebral concussion and fracture of the ribs. He died the third day after admission into the hospital. In the sixth case—a very emaciated child with phosphaturia—the wound would not heal; amputation was performed, but he gradually sank exhausted. It seems to me that excisions of the upper limb are attended with less danger to life than any other operation of equal severity.

In regard to these statistics of my experience in the excisions of the upper extremity, I have been struck with the great difference in the number of excisions of the wrist and shoulder in comparison with those of the elbow-joint.

Looking over my journals of private and hospital cases, I find that this disproportion seems due to three causes:—*1st*, That diseases of the wrist and shoulder seem to be of very much rarer occurrence; and *2dly*, That they are in the early stages more amenable to treatment; and *lastly*, That many refuse to submit to any operation till the parts are so disorganised and the health so bad that amputation is the only resource. In one year alone I find that of 7 cases of disease of the shoulder 5 were dismissed cured by the use of the cautery, combined

with the use of cod-liver oil, iodide of potash, and nutrient diet, whilst only 2 required excision. In the same year 5 cases of wrist disease occurred,—two refused to consent to excision, and were relieved by treatment, one was dismissed cured, in one amputation was performed, and one underwent excision and recovered.

In the lower extremity the results in regard to life are not so favourable. Excision of the knee-joint, so far as the operation has yet been tested, can scarcely contrast favourably with amputation at the lower part of the thigh for disease of the knee-joint. I am aware that favourable comparisons have been made by contrasting cases of excision of the knee-joint with amputation of the thigh generally; but the comparison, to be a fair one, must be between cases of amputation performed for diseased conditions similar to those for which the excision is had recourse to. My experience of amputation has shown me that, not only the extent of the limb removed, but also the nature of the disease for which it is removed, make a great difference as to the success or fatality of the operation, and that amputation in cases of simple strumous disease of the knee-joint affords the greatest amount of success; and this is the class of cases for which we perform excisions. With all my feeling in favour of excision of the knee-joint as a substitute for amputation of the thigh, I cannot help believing that in certain conditions it is more dangerous than amputation, and that the character of the operation is likely to be perilled by its being indiscriminately resorted to. In reference to the absolute advantages of excision of the knee over amputation as regards the results in successful cases, no one can doubt that; and I think the question now to be considered in regard to the comparative mortality of these operations is to endeavour to discriminate between the cases in which the one or the other of these operations presents the least risk to life. Here, as in amputation, it is difficult or impossible to gain much from mere general statistics. What we want to know in considering such a point is, all the circumstances of the cases operated on, which may have influenced the result, and hence the surgeon will learn more from, and naturally be more impressed by, the results of his own cases, or of cases which he has opportunities of closely observing. My own experience of excision of the knee-joint is comparatively limited, and therefore, in stating to you the results, any deductions I may draw from my cases are to be regarded as merely suggestive, not positive.

Up to the time when I published the first edition of these Lectures I had performed excision of the knee-joint 18 times; of these 10 recovered, and 8 died, 17 of the cases operated on were for disease, and 1, a primary excision, for injury. 14 of the patients were females, and 4 males.

Of the 10 successful cases 9 were females: in 6 of these the ages varied from 20 to 25; 1 was a little girl, aged 7; and 1 was a young man, aged 20.

The diseased conditions for which the operation was performed were as follow:—In the cases of the young adult females there was disease of the articular ends of the bones, leading to ulceration of the cartilages, attended with great local pain and constitutional disturbance.

ance; but in all of them, notwithstanding the severity of their suffering, there was less wasting of the body and less impairment of the general health and strength than might have been expected. In the case of the young man, ankylosis in the bent position had resulted after long-continued disease of the knee-joint, which, so far as the history could be ascertained, seemed to have been disease of the bones and cartilages; and at the time of his admission into the hospital there were deep-seated pains in the bones, and the section removed showed the existence of articular caries at some points where the osseous ankylosis was incomplete. His general health had previously suffered during the progress of the disease, but he had regained health and strength after the joint became stiff, but was again beginning to suffer, from the pain preventing rest at night. In the case of the female child, the disease was originally gelatinous degeneration, which had yielded to treatment in the hospital on a previous occasion, but had begun afresh. In her case, also, the joint was partially stiff; her general health was beginning to suffer, but she was by no means exhausted at the time of the operation. In this child's case there was very severe hæmorrhage from the bones some hours after the operation, which could only be arrested by a pad of lint, dipped in perchloride of iron, being placed between the condyles of the femur and tibia, and retained for some hours; after its removal no more bleeding occurred.

Of the fatal cases, one was a case of primary excision in a man about 45 years of age, who jumped from a railway carriage whilst the train was in motion. He sustained several other injuries—concussion of brain and a small lacerated wound of the scalp, and simple fracture of the upper arm. The injury of the knee consisted of a very fine semilunar wound (made nearly as cleanly as with a knife), laying open the knee-joint. The convexity of the flap looked upwards—that is, in the direction opposite to that in which we should make the incision in operating. The internal condyle of the femur was fissured, and fragments broken off. No new incisions required to be made. The slices of bone removed were not of any great thickness, and no ligatures were required. At first the injury of the head rendered him restless and difficult to manage, but after a few days the head symptoms passed off, and he went on most favourably for more than three weeks, when suddenly rigors occurred, pyæmia set in, and he died about five weeks after the injury. The lower end of the femur, above the section of the condyles, was found bare, as from acute necrosis. There was no swelling of the thigh to be seen or felt during life, nor did he complain of uneasiness at the wound, a great part of which was consolidated.

Another of the fatal cases occurred in a man about 30 years of age, of very strumous constitution and spare habit of body, but not very much exhausted by the disease, which was chronic gelatinous degeneration of the synovial membrane. In this case the cause of death was very obscure. The operation was very easily and quickly performed; there was less than the usual amount of bleeding during the operation, and the wound was not a large one. After the operation some venous bleeding occurred, which, however, was quickly and easily arrested by

snipping the bandage above the knee and applying cold. There was no bleeding into the cavity of the wound—no distension—and the ends of the bone were kept in accurate apposition; but he never rallied fairly from the operation, and died within forty-eight hours. There was no affection of the lungs or chest to account for death. I presume we must classify the cause under the convenient term of “shock,” though, as he was not at all nervous prior to the operation, and felt nothing of it, and was neither restless nor complained of pain after it, it is difficult to understand in what the “shock” consisted.

A lad, aged 19, on whom I operated for gelatinous degeneration, died under peculiarly annoying circumstances. So far as the excised knee-joint was concerned, the wound healed nearly by the first intention, and consolidation proceeded favourably. So little pain did he suffer that he never moved the limb in the slightest degree, and the apparatus never required to be removed for five weeks, and then only to change the bandages for cleanliness. His appetite was good, and he slept well. The only bad symptom was that the pulse was more frequent than consistent with the general symptoms. He was looked upon as convalescent, when suddenly the opposite foot and leg began to swell. The urine, which had formerly been normal, was now found to contain albumen in considerable quantity. Notwithstanding all treatment, the condition proceeded, occasionally yielding for a time, and then becoming worse. He died nearly four months after the operation, the wound having healed long previously.

In two others of the fatal cases the patients were females, one 40 years of age, and the other 45. Both had on former occasions suffered from necrosis of the femur, which had been cured previously to the appearance of the affection of the knee, for which excision was performed. Both did well for some weeks, and then pyæmia, complicated with albuminuria, supervened and terminated fatally. Pyæmia also proved fatal in the case of a female, aged 35, on whom I performed excision for gelatinous degeneration; and a very acute form of pyæmia caused the death of a young girl on whom I operated on account of acute ulceration of the cartilages, arising from disease of the bone. In this case the girl had suffered excessively from pain and irritative fever before admission into the hospital. I was anxious for a post-mortem examination in the last case, but it was not granted.

The last of the eight fatal cases occurred after excision for ulceration of the cartilages caused by masses of fimbriated bodies from the synovial membrane. The patient, a female, though nervous and excitable was not by any means weak, but suffered intense pain on moving. The disease, though extensive in surface, was of little depth. The sections of the bones were accordingly very thin, and the bone underlying the sections removed was sound, and rather more solid than usual. All the synovial membrane was carefully removed. The disease seemed so completely local and limited, and the general health so good, that I anticipated a very favourable result, but she became very excited and depressed mentally, and died within a week after the operation, apparently from constitutional irritation, and without any symptoms of pyæmia.

I have entered more fully into the nature of the fatal cases, with the view of directing your attention to some circumstances in regard to them. As to the successful cases, I have only to remark that, with the exception of the little girl, they all presented certain features in common. In all, the disease was in osseous texture, and tolerably limited. All of them were young adults, and in none of them were the general powers of the constitution exhausted, although the local sufferings were in most of the cases intense. They were, in fact, cases which augured well for the result, and good specimens of a class of cases which I had indicated in some remarks on excision of the knee, in my Clinical Reports 1858-9, as being specially suitable for the operation—viz. "cases where we find severe local disease of the joint, apparently limited, and of long standing, resisting all the usual remedies, and becoming exacerbated whenever the patient tries to use the limb, but where, at the same time, the general health has not suffered in any great degree."

The causes of the issue in the fatal cases are deserving of attention. The result in the case of primary excision is scarcely to be wondered at. The man was above middle age, intemperate, and suffered various other injuries; and it accords with my experience of primary amputations, that the presence of other lesions, although not even very dangerous in themselves, such as simple fracture of another limb, or slight injury of the head, have always a most marked influence in determining an unfavourable issue at a late period, and in an insidious form, as in the case alluded to, apparently depressing the vital power and inducing pyæmia. I think the nature of the cases with which we have to deal in civil practice, as exemplified in the fatal cases of primary excision at the knee and elbow which I have recorded, serves to explain the difference from the great success in primary excisions in military practice for bullet-wounds; but whilst we cannot consider such cases as mine as favourable for excision absolutely, I believe that their chances were at least as good as, I should say better than, after primary amputation in similar circumstances, and in less complicated cases decidedly preferable. As to the cases in which the excision was performed for disease, the two in which the fatal result is least explicable, and where I certainly anticipated success from the conditions present, is the case of the man who died forty-eight hours after the operation, apparently not rallying from the "shock." I have given the details, but as I confess I have never been able to satisfy my own mind as to the cause of death in his case, I shall not waste your time by attempting any explanation. The other case is that of the young woman with fimbriated disease of the synovial membrane, and ulceration of cartilages and subjacent osseous surfaces. In her case I expected, from the perfectly healthy state of the bones beyond the ulcerated surfaces, the limited nature of the disease, and its complete removal, and the absence of all marked strumous diathesis, that there was less than usual risk, but she died very rapidly from irritative fever rather than pyæmia. She was excitable and nervous, and I believe her restlessness kept up the local, and so induced the constitutional irritation. At the same time, the question suggests itself, how far the

diseases of the synovial membrane are favourable for this operation. In the case of the lad who died of albuminuria, and also in the case of a female thirty-six years of age, the disease was gelatinous degeneration of the synovial membrane, which was completely and readily removed. It seems rather hard to have to count the lad's case as fatal from the excision, for I never saw a case of excision where the operation was attended with less local or general disturbance, or where the wound healed more kindly. I have, however, pointed out the tendency to amyloid degeneration of the kidney, and also to congestion of the kidneys and acute albuminuria, in cases of gelatinous disease of the synovial membrane, and therefore I fear we must look to this as one of the causes of fatal issue when we are estimating the chances of success, and in all such cases it should ever be borne in mind with reference to the after-treatment of our cases. In the case of the woman, her age, and the long continuation of the disease, were also unfavourable elements. In many instances of synovial degeneration, especially in cases in which, under previous treatment, partial ankylosis has been effected; and where the patient is not much exhausted, excision of the knee-joint is suitable. But I cannot consider that gelatinous degeneration is so favourable as articular caries, owing to the state of the constitution which generally accompanies the former condition. In cases of young lads, or boys of pale, pasty-looking complexion, and in whom abscesses containing curdy or tubercular-looking pus, have formed around the joint, I should decidedly give the preference to amputation of the thigh, as being attended with less risk to life. The remaining two adult females who died after the operation had both suffered for years from scrofulous necrosis of the shaft, which had been cured prior to the knee becoming affected.

In regard to amputation of the thigh, I shall have occasion to point out to you, as the results of my experience, that the pre-existence of necrosis to joint-disease makes a marked difference on the unfavourable results of amputation at the lower third of the thigh, and here we find the same holds good. This, as I have said in reference to amputation, seems to me to be due to blood-taint in scrofulous necrosis, and the previous long-continued irritation and suppurations during the progress of the necrosis, so that even when the bone has separated, and wound healed, the recurrence of the joint-disease indicates an unfavourable state of the constitution, whether for amputation or excision. Another unfavourable element in these two cases was the age of the patients, one being forty and the other forty-five years of age. In the case of the girl who died, the disease was acute cario-necrosis; and when admitted into the hospital, she was suffering from intense irritative fever. When this was subdued, the disease being limited, I considered her case suitable for excision; but I fear the state of the blood and nervous system in such cases is unfavourable for the operation, and that amputation would probably have a better chance of success. The unfavourable conditions then are—debility from disease, or originally weak constitution, advanced age—beyond forty years of age is, as a general rule, unfavourable for excisions of the knee—and the coincidence or previous existence of necrosis is also an unfavourable complication in my estimation.

Such were the results of my practice in excision of joints up to 1870. In preparing this edition, however, I found that the statistics of my later operations presented some marked differences from these, and I therefore considered that it would be more instructive to keep the two series of statistics distinct at first, and then combine them in a tabular form.

Since 1870 I have had 8 cases of excision of the shoulder joint, and of these 6 recovered and 2 died. In one of the fatal cases the operation was performed for secondary disease proceeding from an injury of the joint. Twelve days after the operation he had a rigor, and on examination of his chest partial consolidation of both lungs was discovered. The discharge from the wound was considerable, diarrhoea set in, and pyæmia supervening, he died seventeen days after the operation. The other fatal case was that of a young woman, in whom, although the pain was intense, the amount of disease in the head of the humerus was very limited, and the soft textures external to the joint were unaffected. She had, however, suffered from irritative fever due to the disease.

Out of 40 cases of excision of the elbow-joint there were 32 recoveries and 8 deaths. Of the latter one died from delirium tremens, another from phthisis, a third from bronchitis, and a fourth from acute albuminuria. In the remaining 4 the order of events were the following:—In the first, hæmorrhage, weakness, and pyæmia; in the second, surgical fever, and death six days after the operation; in the third, erysipelas, gangrene, exhaustion; and in the last, where an abscess had formed and opened spontaneously before the operation, there were rigors five days after the excision, secondary hæmorrhage three days later, and death on the fourteenth day. Of the “recoveries” two were cases of re-excision. The previous operations had been performed, respectively ten and twelve years before. In the latter the humerus was found projecting below the upper ends of the radius and ulna. In the former there were two sinuses which had been open for eight months, and the operation disclosed disease of the humerus and radius.

Of 3 cases of excision of the wrist by single linear incision all made a good recovery.

In the lower extremity the statistics of my later operations show much more favourable results than the former series. Out of 9 cases of excision of the knee-joint 7 of the patients recovered, and only 2 died. In the first of the fatal cases death occurred from double pneumonia a month after the operation. In the second the patient had been complaining of the knee for six years, and in addition to extensive disease of the joint there was spontaneous dislocation of the tibia forwards and inwards. Death from pyæmia took place thirteen days after the operation.

Out of 5 cases of excision of the hip-joint 2 recovered and 2 died, and the fifth recovered after amputation at the hip (see *Clinical Cases of Amputation*). In the first of the fatal cases the patient was pale and anæmic. She had an abscess over the hip-joint, which burst spontaneously and took the form of a sinus on the outer aspect of the thigh. Death was caused by extreme exhaustion, without pyæmia. In the

other the operation was performed early, before abscesses had formed in the soft parts, which were perfectly healthy; and although the interior of the joint was largely affected, the patient was in tolerably good health, but after the operation became restless and irritable. An abscess formed in the neighbourhood of the joint, and nine days after the excision this was opened. The patient gradually sank, and died two days later.

In one case of excision of the ankle-joint for strumous disease the patient recovered.

The following is a view, in a tabular form, of these two series of statistics combined:—

I. UPPER EXTREMITY.

(1.) *Excision of the Shoulder-Joint.*

A. Injury—	No.	Recovered.	Died.
(α) Primary (gunshot wound)	1	1	0
(β) Secondary (disease following injury)	1	0	1
B. Disease	23	22	1
Total	25	23	2

(2.) *Excision of the Elbow.*

A. Injury	4	2	2
B. Disease	148	136	12
Total	152	138	14

(3.) *Excision of Wrist.*

Total	11	11	
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II. LOWER EXTREMITY.

(1.) *Excision of the Hip-Joint.*

A. Injury	0	0	0
B. Disease	5	(a) 3	2

(2.) *Excision of the Knee.*

A. Injury	1	0	1
B. Disease—			
Gelatinous disease	22	15	7
Ulceration of cartilages from disease of bone	2	0	2
Disease of bones and cartilages with ankylosis	1	1	0
Ankylosis	1	1	0
Total	27	17	10

(a) One recovered after amputation at hip.

(3.) *Excision of the Ankle.*

	No.	Recovered.	Died.
A. Injury	0	0	0
B. Disease	1	1	0
Total	1	1	0
Total number of Excisions	221	193	28

A comparison of the difference between the results of first and second series of statistics of Excisions of Joints is, I think, calculated to suggest some useful instruction.

It may serve to show how cautious we should be in attributing success to some special mode of treatment, even when our statistics are founded on a large number of cases, and extending over a long period. In my practice prior to 1870, or for a period of above thirty years, I had performed excision of the elbow-joint 112 times, with only 6 deaths; whilst, during the succeeding five years, out of 40 cases I have lost 8, or 1 in 5. Yet there has been no change in my method of operating or treatment. The nature and extent of the disease or injury, or the constitutional condition of the patients operated on, form the true explanation of the increased mortality in the later series. The view given in the general statistical table, showing the combined result, would not suggest any important consideration; it would merely show that out of 152 excisions of the elbow there had been only 14 deaths.

Again, when we contrast the results in cases of excision of the knee-joint, there is seen a much more favourable result in the later than in the earlier statistics, for whilst the results up to 1870 were 10 recoveries and 8 deaths in 18 cases, the later series since 1870 show 7 recoveries and 2 deaths in 9 cases. This favourable change in the results of my excisions of the knee is, I believe, greatly due to the experience of former years having led me to exercise great care in selecting proper cases for the operation, and in eliminating those in which the nature of the disease or its complications, the age or debilitated state of the patients, seemed unfavourable for such an operation.

In regard to excisions in the upper extremity, from the extreme rarity of fatal cases and the long intervals between their occurrence, I had come to look upon operations, such as excision of the elbow and shoulder, as almost devoid of danger, and hence I never thought of amputating in these cases. Whilst even yet I would be very loath to amputate in disease of the elbow-joint, my later experience has shown me that in some unhealthy patients amputation would be attended with less risk to life.

Amongst the excisions of the enarthrodial articulations of the hip and shoulder joints there are three fatal cases which deserve special notice, inasmuch as they seem to tell against operative measures in certain cases. In all three cases there were these conditions in

common: The local pain in the joint was excessive, even when the limb was at rest; a great degree of irritative fever, arising at an early period of the disease; and, finally, in none of these were the textures external to the joint nor the capsular ligament affected. In one of the cases, that of a young woman in whom excision of the shoulder was performed, the diseased surface of the head of the humerus and cartilage was scarcely the size of a fourpenny-piece, but the pain and constitutional disturbance had resisted treatment by the cautery, and all other remedies.

In another case, of a young man who had suffered from an injury of the shoulder, and who also had rheumatic fever some years previously, I found alteration in the form of the head of the humerus and a considerable amount of carious ulceration, but no appreciable disease of the capsular ligament or of the deltoid, nor any trace of suppuration external to the joint. In the case of hip-joint disease the affection had been of a very acute character, accompanied with most intense suffering, but the soft textures were unaffected, and the limb presented the appearances of the first stage of hip-joint disease, although within the capsule there was pus, ulceration, and caries of the head of the femur, and also of the acetabulum. In all these cases, rest, distraction of the articular surfaces, and the cautery, together with constitutional treatment, had afforded but little relief, and excision was performed so soon as the irritative fever was subdued; but in all of them, though every local condition seemed favourable, irritative fever supervened very soon after operation, and led to a fatal termination. In all the operation was very easily performed, and without any loss of blood. Sir Benjamin Brodie long ago drew attention to cases of acute disease in the hip and shoulder, in which the patients died from intense pain and irritative fever, but in which the affected joint showed only a very limited amount of local disease, seemingly inadequate to account for the constitutional disturbance. It would seem as if the intensity of the symptoms depended upon some peculiar irritability of constitution, combined with or arising from acute local disease, unfavourable as regards prognosis under any treatment, but most unfavourable for operative interference.

STATISTICS OF EXCISIONS (1875 to March 1882).

I. UPPER EXTREMITY.

(1.) *Excision of the Shoulder-Joint.*

A. Injury—	No.	Recovered.	Died.
(α) Primary	0	0	0
(β) Secondary	2	1	1
B. Disease	6	6	0
Total	8	7	1

(2.) *Excision of the Elbow.*

A. Injury	6	(a) 5	1
B. Disease	(b) 31	30	1
Total	37	35	

(3.) *Excision of Wrist.*

Total

II. LOWER EXTREMITY.

(1.) *Excision of the Hip-Joint.*

A. Injury	0	0	0
B. Disease	14	10	(c) 4

(a) One of these cases was that of a healthy lad of 20, who, a fortnight previous to admission had injured his left elbow by a fall. On admission the whole arm was found to be much inflamed and swollen with a discharging wound at the posterior aspect of the elbow-joint. Fracture of the olecranon was made out. Next day the wound was enlarged and a quantity of pus evacuated from the joint. On the following day, excision by straight posterior incision was performed. Owing to the swelling and tension no sutures were put in. The limb was retained in position by suitable pads of lint. In five weeks' time the wound was healed, and the operation left a perfect result.

(b) Twelve excisions were for disease. Of these six had sinuses communicating with the joint or necrosed bone, while six had no sinuses in connection with the joint. Of the six with sinuses, three became septic in from 4 to 14 days. The other three remained aseptic, but in one case the spray had to be discontinued from the breaking down of the cicatrix of the incision, which had healed by first intention; while in another the spray dressings were stopped to prevent erythema, as it had caused it in a previous operation on same patient.

Of the six without sinuses, four remained quite aseptic, but spray dressings had to be discontinued on account of the breaking down of cicatrix in one case. In two of the cases the further treatment is not recorded. One of the six was for ankylosis of elbow.

(c) One of these was the case of a delicate strumous child. The joint was excised, but a large abscess communicated with pelvis. The antiseptic dressings had to be discontinued in a few days, as the child was passing urine and feces involuntarily. The wound made considerable progress, but the child was taken from hospital in a very low state of vitality, and died a few days after removal.

(2.) *Excision of the Knee.*

	No.	Recovered.	Died.
A. Injury	1	1	1
B. Disease—Gelatinous Disease	4	4	0
Total	5	5	0

(3.) *Excision of the Ankle.*

A. Injury	2	(d) 1	1
B. Disease	0	0	0
Total	2	1	1
Total number of Excisions	68	60	8

STATISTICS OF EXCISIONS (Combined Results)

I. UPPER EXTREMITY.

(1.) *Excision of the Shoulder-Joint.*

A. Injury—			
(α) Primary	1	1	0
(β) Secondary	3	1	2
B. Disease	29	28	1
Total	33	30	3

(2.) *Excision of the Elbow.*

A. Injury	10	7	3
B. Disease	179	166	13
Total	189	173	16

(3.) *Excision of Wrist.*

Total	16	16	0
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II. LOWER EXTREMITY.

(1.) *Excision of the Hip-Joint.*

A. Injury	0	0	0
B. Disease	19	13	6
Total	19	13	6

(d) The excision of the ankle made a good recovery. It was for a compound dislocation. The further reports of the antiseptic treatment are not reported.

STATISTICS OF RESULTS.

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(2.) *Excision of the Knee.*

	No.	Recovered.	Died.
A. Injury	2	1	1
B. Disease	31	21	10
Total	33	22	11

(3.) *Excision of the Ankle.*

A. Injury—Compound Fracture and Dislocation	2	1	1
B. Disease	1	1	0
Total	3	2	1

Total number of Excisions	290	253	37
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STATISTICS OF EXCISIONS TREATED ANTISEPTICALLY (1878-1881).

Upper Extremity—

Shoulder—Disease	1	1	0
Elbow—			
Injury	1	1	0
Disease	12	12	0
Total	14	14	0

Lower Extremity—

Hip—Disease	4	3	1
Knee—Injury	1	1	0
Ankle—Injury	1	1	0
Total	6	5	1

Number of Excisions Treated Antiseptically	20	19	1
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LECTURE LXXI.

SPECIAL EXCISIONS—Excision of Shoulder-Joint : Steps of the Operation : After-treatment—Excision of Elbow-Joint by Longitudinal, H and T Incisions—Circumstances under which one or other should be preferred—Operation—Excision of Wrist-Joint—Instruments used and Operative Procedure.

THE general principles on which excision of joints should be performed having been considered, I shall now describe the methods of performing the principal excisions or resections, commencing with those of the upper extremity.

EXCISION OF THE SHOULDER-JOINT has been very frequently performed in cases of disease of the head and tuberosities of the humerus, or for gunshot wound ; and various lines of incision have been tried to effect this resection. Mr. White of Manchester, who was amongst the first to propose this operation, used a single longitudinal incision through the central line of the deltoid. Others dissect up either a semilunar, or V-shaped flap of the deltoid, so as to expose the surface of the joint, open the capsular ligament, turn out the head of the humerus, and saw it off immediately below the tuberosities. The plan of operation, however, which I consider to be preferable to all others, as enabling the surgeon to disarticulate with greatest ease and with least loss of blood, is a longitudinal incision made over the internal aspect of the joint, which enables the operator to expose the head and tuberosities of the humerus, where they are most prominent between the coracoid and acromion processes of the scapula, then by a slight rotation of the arm outwards, to expose and render tense the broad attachment of the subscapularis into the lesser tuberosity, and to divide this easily, which may be said to be the key of the operation. Again, when in a dissection we reflect the deltoid muscle, it will be observed that the great posterior circumflex artery, which supplies the deltoid chiefly, attaches itself to the deep surface of the posterior part of that muscle after winding round the neck of the humerus below the tuberosities ; and this large vessel being only loosely connected, would, if divided posteriorly, retract and bleed very copiously. As it passes forwards, however, entering the substance of the deltoid, it diminishes in size, and, at the anterior margin of the deltoid, only exists in the form of its ultimate muscular twigs ; it follows that both in excision and in amputation at the shoulder, we should if possible avoid division of this artery near its origin, or where it lies under the posterior portion of the deltoid.

The operation is performed as follows :—The arm being

abducted, the surgeon feels for the projection of the head of the humerus immediately external to the coracoid process, and entering his bistoury just in front of the inner aspect of the acromion process, he cuts directly down upon the head of the humerus, and carries his incision deeply, downwards and slightly outwards for at least three inches and a half, or four inches. This incision should fairly divide the deltoid. On drawing aside the margins of the incision with blunt hooks, the internal and anterior aspect of the joint is seen, and the long tendon of the biceps lying in the upper part of the bicipital groove. This tendon, if

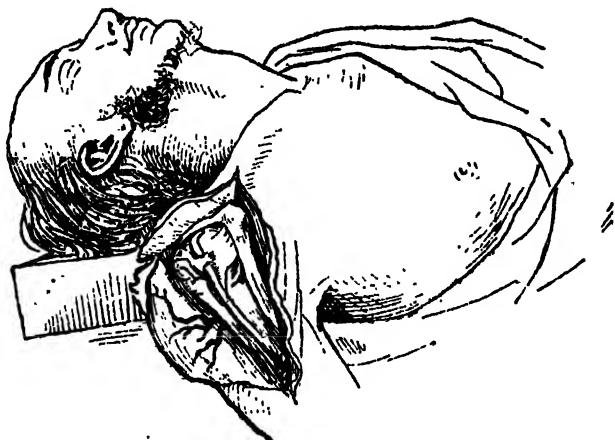


Fig. 152.

healthy, can be saved by slitting up its confining sheath and drawing it aside. The anterior circumflex artery is generally divided in this first incision; and this, as well as any small muscular branches which bleed, should be secured before proceeding further. The external margin of the wound is then drawn well outwards, and if the deltoid be very powerful, or its fibres altered and condensed by disease so as not to allow it to be easily retracted with the skin, a small incision may be across its anterior fibres immediately under the acromion. This thoroughly exposes the external tuberosity. As the arm hangs well over the table, the assistant moves the elbow slightly backwards to project the head of the humerus forward, and the surgeon, using his knife as if he were about to cut into the bone, divides at one sweep the capsular ligament and the attachments of the muscles inserted into the greater tuberosity. The joint is thus largely opened, and then, by rotating the arm outwards, the tendon of the subscapular muscle attached to the lesser tuberosity of the humerus is brought fully into view, and easily divided. The arm hangs loosely, and the assistant projects the head of the humerus by drawing back the elbow (the elbow in this method of operating should not be thrown across the chest, as that buries the head of the humerus under the deltoid), so as to allow the surgeon to divide any portions of the capsular ligament which

Fig. 152. Dissection of shoulder referred to on opposite page.

remain, and to clear the bone for sawing it below the tuberosities. In this part of the operation the edge of the bistoury should be constantly directed towards the bone, so as to avoid injury to the posterior circumflex artery, or even the great vessels; and in cases of disease, when the textures are very unyielding and incision contracted, it is advisable to use a blunt or round pointed bistoury for this part of the operation. When the head of the bone is sufficiently cleared and projected, by the arm being drawn forcibly back and maintained firmly in that position, the operator, steadying the head of the humerus with his left hand, applies the saw and removes the diseased or injured part, taking care to remove no more than what is absolutely necessary. Any vessels which bleed are now secured, and then the state of the glenoid cavity is carefully examined. If not diseased, nothing further is required—if diseased, the carious portion may be removed with the gouge-forceps, or bone-pliers and gouge, or the whole glenoid articular surface may be clipped off with large curved bone-pliers; but this is seldom required. When there has been much suppuration in or around the joint, I usually, after the resection is completed, introduce my left forefinger into the wound and pass it downwards and backwards to the most dependent part of the cavity, and then, introducing a bistoury upon the finger, make a counter-opening of about an inch and a half in length, to allow the discharge to escape freely in that direction. A piece of perforated india-rubber tubing is passed through the wound, to keep the track open, and enable us to wash out the cavity with antiseptic lotions. This plan I have found very useful in preventing the matter collecting in the cavity of the wound when the patient is lying on his back.

When the operation is completed, the incision is united by points of interrupted suture. A long flat pad, thicker above than below, and covered with gutta-percha, is placed in the axilla and between the arm and the side, the forearm and elbow supported in a sling, and the elbow fastened to the side by a circle of broad bandage. The wound, after being washed out, is simply dressed with lint, soaked in boracic lotion, except in cases where there has been much suppuration. In such cases I wash the wound with solution of chloride of zinc (1 part to 30 or 40), and use a weak tepid chlorinated soda lotion for dressing, for some days. At the end of four or five weeks, gentle passive movements of rotation and abduction should be cautiously begun. The general result of this operation is most successful. I have performed the operation twenty-five times, and some of these cases looked very unpromising, but I have lost only two patients; while in all of the successful cases the arm left has been most useful, and in many the amount of power regained was very surprising. The patient represented in plate XVI., fig. 2, seemed, prior to the operation, a very hopeless case, but his general health and muscular power have been re-established ever since the removal of the diseased parts.

EXCISION OF THE ELBOW may be effected either by means of a simple longitudinal incision, or by incisions in the form of H or T. As I have already indicated the general principles to be attended to in planning our incisions in resections of joints in the upper extremity,

the section of muscles and tendons in these operations, in the after-treatment and usefulness of the limb, I shall now turn myself to describing the steps of the operation—beginning with the operation by the longitudinal incision, which, as a general method, I prefer.

In performing this operation, the circulation having been commanded through the limb, the assistant, standing on the side of the patient opposite the diseased limb, grasps the arm above and below the elbow, keeping it very slightly flexed and raised from the body. The surgeon, standing on the same side as the diseased limb, inserts his knife in the middle line of the posterior aspect of the upper arm, about two and a half inches above the elbow, pushes it directly down to the bone, and carries it rapidly downwards, inclining the incision a little inwards as it passes over the olecranon and upper part of the ulna, and terminates the incision two or two and a half inches below the joint. He should next separate the triceps on the outer side by cutting very obliquely downwards and outwards, the edge of the knife being directed to and rasping upon the ulna, so as to separate the muscular fibres in connection with their periosteal attachment; and then this deep incision is continued downwards and outwards to separate all the textures over the outer condyle and head of the radius. This relieves the tension, and enables the operator to deal more easily with the more important step of separating the parts on the inner side of the joint. The surgeon divides the inner half of the triceps in the same manner as on the outside; but on reaching the line of the internal margin of the olecranon, the operator must recollect the proximity of the ulnar nerve, and to avoid injuring it, must keep the edge of the knife directed towards the ulna as he cuts downwards. He then separates the parts from the humerus and ulna sufficiently to enable the textures, including the ulnar nerve, to be drawn over the internal condyle and allow it to be fairly exposed. The assistant should now bend the arm further, to render the lateral ligaments tense, so that they may be freely divided. Their division is most readily effected by cutting upon or just below the condyles of the humerus, where the ligaments are narrowest, and can be divided by a single stroke of the knife. The elbow is then forcibly flexed, and the upper ends of the ulna and radius dislocated or projected backwards, exposing somewhat their anterior aspect, which may be still attached by the anterior ligament or portions of it. The operator clears the anterior aspect of the coronoid process by cutting obliquely down to and upon the bone, so as to separate the periosteal attachment of the brachialis anticus tendon from the bone, then, clearing the radius and ulna by a circular sweep of the knife, he applies the long narrow saw, and cuts them through a few lines below the lesser sigmoid cavity of the ulna. Lastly, he clears the lower part of the humerus, and saws it off through the upper part of the olecranon fossa, and rounds off the angles of the section with the bone-pliers. All diseased synovial structure should, as far as possible, be clipped away or dissected off; and any portion which remains, or any suppurating texture, should be painted over with a solution of chloride of zinc (1 part to 30). The vessels which usually require to

be secured are the branches of the inferior profunda which anastomose the ulnar nerve, and the anastomotica magna on the inner side with the radial recurrent and posterior terminal branch of the superior profunda externally; but all bleeding points must be secured by ligature or other means, before closing the wound, which is then to be closed by an interrupted suture. The central stitches should be left untied, the wires or thread being left long so as to be tied after six or eight hours when all oozing has ceased, and after any clots which may have formed have been removed. The dressing is simple: a long, rather thick pad of antiseptic gauze, of the breadth of the limb, is placed in front of the arm, which is kept slightly flexed, then two lateral pads on either side of the wound. These pads are secured by a figure-of-8 bandage, so applied as to leave the wound free, a light veil of lint is laid over the wound, or no dressing at all to the cut surface. The limb is then laid on a pillow, and the arm secured so as to prevent the humerus being tilted outwards, which would cause the condyloid end of the bone to press upon the skin, and might lead to ulceration. A light extension weight may be applied merely to steady the limb, in order to prevent, as far as possible, any undue movement.

In cases where the joint is ankylosed the soft textures may be dissected off, so as to allow the removal of the articulation in a mass after resection with a fine narrow saw, or the operation may be facilitated by cutting off the olecranon with bone-pliers; and some surgeons take this latter method in all cases, but there is really no necessity for doing so generally.

Excision of the elbow by the H or \neg incision is very similar as to the final steps of the operation, the chief difference being in the dissection of the parts on the posterior aspect of the joint in the form of flaps, so as to expose the bones more fully. In either of the two plans last mentioned the operator begins by making a transverse cut from the internal margin of the olecranon process to the articulation between the outer condyle of the humerus with the head of the radius. He next makes an incision, about three inches long, parallel to the axis of the limb, and close along the inner border of the olecranon. This completes the lines of the \neg incision. If the H incision is to be used, another longitudinal cut is made at the outer end of the transverse incision. In both methods the surgeon next proceeds to separate the parts between the internal incision and inner condyle; and as these contain the ulnar nerve, the edge of the knife should be kept close to the olecranon and ulna, to avoid injury to the nerve, and then the separated parts drawn inwards, and protected by a broad metallic spatula. The flaps marked out by the line of incision are dissected from the bones, the lateral ligaments divided, the ends of the bones dislocated, and projected and sawn off, as described in the operation by the single longitudinal incision.

In these last methods everything depends on primary union of the transverse incision taking place, and hence the limb must be kept very quiet. Should primary union of the transverse cut fail, passive motion cannot be begun without interfering with the healing process; whereas in the longitudinal method we can begin passive motion, even the

primary union should fail, without doing harm. Having performed the operation repeatedly by all three methods, I feel satisfied that the long posterior incision is preferable in many respects, and quite as easy of performance as either of the other two.

In cases of ankylosis resulting from injury, or for certain cases of unreduced dislocation of the elbow-joint, partial excision by resecting and removing the condyloid and trochlear surface of the humerus may be practised with advantage, leaving the attachments of the triceps and brachialis muscles to the ulna intact, thus preserving the movements of flexion and extension much more perfect than can be done in cases of complete excision.

My colleague, Dr. Watson, has performed this operation several times.¹ He makes a single longitudinal incision along the inner side of the olecranon, as in the case of an ordinary excision, but rather more prolonged in the upper arm.

The ulnar nerve and soft parts having been dissected off and turned over the internal condyle, the lower part of the humerus is cleared by passing a probe-pointed knife in front or behind the condyles, close to the bone, which is then resected, its articular surface divided into two portions with bone-pliers, and the separated portions removed, the wound is stuffed with a portion of sponge wrung out of carbolic lotion, the incision closed with suture, and the arm bandaged and retained as in excision of the elbow. Unless anything untoward occur, the sponge is not removed until forty-eight hours have elapsed.

The single incision renders it difficult to reach the outer condyle and external lateral ligament. In a case I operated on lately for unreduced luxation of the elbow I made a small incision of about two inches over the outer condyle as well as a long internal incision, and after clearing the humerus passed a chain-saw and resected the humerus, and I think this would much facilitate the operative procedure in cases of simple ankylosis after injury. The condyloid portion of the humerus should always be split perpendicularly, to admit of its more easy removal.

Mr. Butcher of Dublin, in his work on *Operative and Conservative Surgery*, describes the following method:—

“New Operation for Bony Ankylosis at the Elbow-Joint.”—I have frequently performed the following operation on the dead body, and a dexterous hand may readily accomplish it in the living. The arm being placed in the same position as that for resection, an incision should be made, about an inch in length, behind the internal condyle, and the ulnar nerve freed from its bed, and drawn forwards with a blunt hook; a second incision should pass outwards to the most prominent part of the external condyle, at right angles with the first, dividing the integuments and ligamentous expansion covering the olecranon. The fine blade of the saw which I use for resection being detached, it should be passed from the extremity of the transverse incision—that is, from without inwards, in front of the condyles and the joint, its flat surface being applied to them; the blade, being sharp

¹ *Edinburgh Medical Journal*, 1873

at the point, can be readily made to pass along this direction, and by drawing the integuments a little in front of the internal condyle, it will appear through the perpendicular incision, or that made in the first instance; the serrated edge may then be turned backwards, the blade connected with its frame, a few movements will sever all resisting parts from before backward, corresponding to the line of the transverse incision through the soft parts; the limb should then be bent at less than a right angle, and any vessels requiring ligatures must be secured. The after-treatment should be exactly in accordance with the rules laid down when speaking of resection. An operation accomplished after this plan is not, I conceive, nearly so serious a measure as excision of the joint; the brachial artery need not be considered in danger, except through undue rashness, and the hopes of a more perfect motion may rationally be expected when no muscular attachments are divided."

I presume Mr. Butcher has not tried this plan on the living, from what he says, and I fear he would be disappointed in his expectations; for mere section of the bone would scarcely suffice to restore and retain motion at the elbow. In cases of excisions for stiff joint we often find ankylosis reproduced even when considerable portions of the bones have been removed.

What has been said of the mode of dressing applies equally to all the methods.

EXCISION OF THE WRIST-JOINT, owing to the nature of the parts to be removed, and the necessity for avoiding the division of tendons and bloodvessels to preserve the movements of the fingers afterwards, is an operation partaking so much of the nature of a dissection that it requires more time and patience on the part of the operator than any of the other excisions of joints. There is not, however, any special difficulty in the operation, apart from particular conditions of the diseased parts, such as the broken-up disorganised condition of the carpus, in some cases necessitating the removal of the diseased fragments, as it were, piecemeal. I have performed the operation, in several cases in from ten to fifteen minutes, whilst in others I have required fully forty minutes to complete it properly.

I formerly used, with some slight modifications, the plan described and figured in Bourguery and Jacob's *Operative Surgery* (plate XVI, fig. 4), only that, instead of the chain-saw there represented, I used a narrow saw, and the bone-pliers, for the section of the bones. I now use a single incision (fig. 153), as described below.

The operative procedure is as follows:—An incision from three and a half to four inches in length is made in the central line of the posterior aspect of the forearm, commencing about an inch and half above the styloid end of the radius, and carried down to an inch below the carpo-metacarpal joint.

This incision should divide only the skin and fascia which are then drawn aside by copper spatulæ or blunt hooks. The operator next carefully dissects the tendons from the grooves on the posterior aspect of the radius, the skin being held aside by means of blunt hooks.

The extensors of the thumb, especially the long delicate extensor tendon of the distal joint, and the radial artery where it lies on the posterior part of the carpus, require special care for their conservation at this period of the operation. The radial extensors inserted into the metacarpal bones of the index and middle finger may be divided when their points of attachment are affected and require to be removed in the resection of the diseased parts. The tendons of the common extensor, and of that of the little finger, are then cleared from the inner part of the radius and groove on the back of the ulna, the inner edge of the incision being held apart to enable the surgeon to do so carefully. In clearing these last-mentioned tendons from the back of the carpus and metacarpus, I direct the assistant who has charge of the hand to bend it backwards to relax the tendons, and then insert my knife under the tendons, where I have cleared them above the wrist, turning the edge of the knife towards the bones, I cut downwards so as to clear the tendons and fibrous textures from the surface of the carpus and metacarpus to the required extent, without risk of division of the tendons. The next step in the operation is to separate the flexor tendons lying in front; and, from their comparatively loose connections, this is readily accomplished by dissecting close in front of the radius and ulna at the outer and inner incisions, and then with the finger, aided by a few touches of the bistoury, the finger or handle of the knife can be passed between the tendons and the bones, whilst the hand is bent forwards to relax the textures. This having been effected

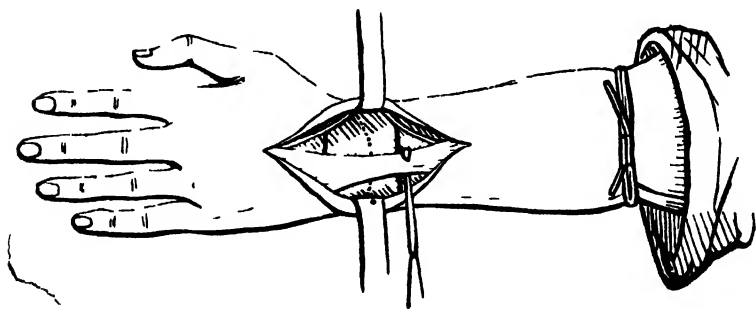


Fig 153

I pass a double fold of broad bandage between the bones and the soft parts on the back of the wrist, to draw them away and protect them during the section of the bones. I then introduce a straight grooved director or a narrow copper spatula between the flexor tendons and the front of the radius and ulna; along its groove the narrow saw or chain-saw is introduced, and the bones sawn through just above their styloid processes from before backwards, or, if more convenient, the director or a narrow metallic spatula being placed so as to protect the flexor tendons, the section of the bones may be proceeded with from behind forwards. In some cases, by merely sawing from the posterior aspect of the bones of the forearm, and then using the blunt periosteal lever or spatula to separate the ends of the bones from the soft parts

on their anterior aspect, the articular extremities of the radius and ulna can be easily removed after their carpal ligaments are divided, and this method is attended with less disturbance of parts and less risk of bleeding. Then each metacarpal bone is snipped through with bone-pliers close to the carpal joint and above the insertion of the radial extensors of the wrist, if the disease does not involve the metacarpal bones. If an attempt be now made to dissect out the mass thus resected, it will almost certainly fail, or require a tedious and not very safe dissection; but if the mass of the carpus and metacarpus be subdivided into smaller portions, each of these can be removed easily and safely. Accordingly, after having snipped through the metacarpal bones, I use the bone-pliers and cut the carpus upwards between the index-finger and thumb; and again, in the same manner, in the line between ring and middle finger. I then seize the portions so marked out with a pair of strong forceps or hook to obtain leverage, and cautiously dissect the bones from the textures in front. The two internal portions having been removed, it merely remains to deal with the external third of the carpus. If the trapezium appears so far sound that I can leave it or its articulating surface with the thumb, I do so, as the usefulness of the hand is thereby much preserved. If not, then I snip off the articular end of the metacarpal bone, and remove that and the remaining portion of the carpus, and also the ends of the ulna and radius if not previously removed. I also leave the pisiform bone when not diseased, as the attachment of the ulnar flexor is thereby preserved. The resection being thus completed, the tourniquet is relaxed, and all bleeding points secured; special care should be taken to secure small vessels deeply seated in the palmar region, as they may prove troublesome afterwards by distending the wound. I generally introduce the points of suture without closing them for some hours till all oozing has ceased. The hand and forearm are then placed on a splint so padded as to allow the hand to rest comfortably. Subsequently it is placed on a special splint fitted to the hand; the splint should be hinged at the wrist, so that after a time passive motion may be used. Of late, instead of bandaging the hand I have fixed it with broad strips of adhesive plaster. /

If the operation be performed by the single longitudinal incision, then I would advise that when the excision is completed and the vessels secured an incision about an inch long should be made on the ulnar side corresponding to the position from whence the styloid process and end of ulna have been removed, so as to permit free drainage when the forearm is placed in the position between supination and pronation. In some cases, the method by double incision, as represented in plate XVI., fig. 4, will be found most suitable, and by either method excellent results may be obtained.

LECTURE LXXII.

Excision of Hip-Joint · Cases suitable for the Operation : Mode of performing it when required—Excision of Knee Joint by Longitudinal, Transverse, and Semilunar Incisions : Operation · Rules for the Permanent Adjustment and After-treatment of the Limb · Dr. Watson's Apparatus—Excision of the Ankle-Joint · Best Method of performing it.

EXCISION OF THE HIP-JOINT.—I have already expressed my opinion that this operation is most generally performed in cases of advanced morbus coxarius, in which the parts are attenuated, and where the articular structures are disorganised, and the diseased head and neck of the femur are lying almost loose or partially lax in the cavity of an abscess, or are to be felt through openings from which pus has been discharged. In such cases, by freely laying open the sinuses over or along the posterior aspect of the great trochanter, and extending the incision upwards and downwards, and curving its extremities slightly forwards, or by converting the longitudinal into a crucial incision, by making a short transverse cut across it a little above the great trochanter, and dissecting the flaps from off the bone, the trochanter and upper part of the femur are exposed. The limb is then carried obliquely across the opposite one, so as to render the trochanter prominent. A bold firm sweep of the knife carried from the anterior to the posterior part of the trochanter upon its upper edge, and downwards along the femur for two or three inches, separates the attachments of the gluteal muscles. When these are detached, the surgeon, by carrying the limb still more across the opposite one, and twisting it, will often be able at once to project and dislocate the diseased portion of the bone, so as to enable him to apply the saw and remove the trochanter and head and neck of the femur. If, however, the capsular ligament still exists, so as to require division, the operator should introduce his finger into the wound, whilst an assistant uses the thigh as a lever to project and twist outwards the head of the femur, and render the capsule tense over it. Insinuating his finger between the upper part of the capsule and the soft parts in front of it, he should introduce the blunt pointed knife, guarded by his finger, and turning its edge towards the capsule, cut directly down upon the projected head of the femur. This will open the capsule, and then the head of the femur will be readily turned out, for the round ligament is usually destroyed by disease ; if not, it can now be easily divided, and the section of the bone performed. Any vessels which may bleed are then secured, the acetabulum examined,

and the gouge applied to remove all disease that can be removed with safety or without perforating into the pelvis. When all oozing has ceased, the wound is closed by sutures, and the limb either laid on padded wire-splint, kept straight by means of the bracketed long-splint, or the extension pulleys, as in fracture of the thigh; only we must avoid much extension, as our object is merely to keep the limb straight and not to keep it of the full length of the opposite, but rather to afford every facility for osseous or firm fibrous ankylosis at the hip taking place.

EXCISION OF THE KNEE-JOINT has been performed by various methods—1st, The **H** incision—two lateral incisions over the outer and inner sides of the joint, connected by a transverse incision in front across the patella. 2d, A single longitudinal incision in the axis of the limb, commencing about two and a half or three inches above the patella, and carried down over the centre of the joint to below the insertion of the ligamentum patellæ; the textures being dissected off laterally to expose the joint, allow the ligaments to be divided and the articular ends of the bones to be sawn off. Lastly, a gently-curved incision from one condyle of the femur to the other, passing below the patella, the convexity of the curve corresponding nearly to the upper margin of the head of the tibia; the semilunar flap, so marked out on being dissected up, freely exposes the articulation for the further steps of the operation. Of these methods I prefer the last, and it is that which is now almost uniformly adopted in this country. The dissection of flaps and exposure of the textures involved in the method of the **H** incision, are unnecessary, and even hurtful. The longitudinal incision, which I consider the most advantageous in the case of the elbow, has no advantage here, as we do not desire a movable articulation, whilst its form and position favour the retention of blood and serous or purulent discharge in the cavity of the wound.

I shall therefore describe and show you the operation by the lunated incision as I usually perform it. The tourniquet having been applied over the femoral artery, the leg of the affected limb is to be supported by an assistant seated in front of the patient, the knee being very slightly bent. If the right knee is to be operated on, standing on the inside of the limb I commence my incision over the posterior margin of the outer condyle of the femur, and carry it down to the upper margin of the head of the tibia; then sweep across the front of the joint at that level, curving my incision upwards, over the inner condyle of the femur to a point opposite that where I commenced. If the case be one of articular caries or ulceration of the cartilages, I carry my incision so deep as at once to divide the ligamentum patellæ and anterior part of the joint, and then divide the lateral ligaments; the semilunar flap, including the patella, is drawn upwards, and the condyles of the femur and tibia separated by bending the knee, so as to expose and facilitate the division of the crucial ligaments. The section of these ligaments should be made by cutting them upon the crest of the tibia, to which they are attached inferiorly, as, by doing so, we avoid risk of injury to the popliteal vessels, which might be injured if we use the

knife carelessly at this stage of the operation, especially when the surrounding textures are much altered and disorganised. When the crucial and lateral ligaments are fairly divided, by elevating the femur, its condyles can be projected sufficiently to enable the operator to saw off as much of the bone as is required. The assistant who supports the leg is desired to project the head of the tibia a little by carrying the foot backwards. The condyloid surface of the tibia is then cleared above the articulation with the fibula. The narrow saw is applied so as to remove a thin slice of the articular surface by sawing from behind forwards. The sharp projecting portions of the section of the femoral condyles are then sawn off or removed with the bone-pliers. The surgeon now applies the sections of the tibia and femur to each other, to see whether their surfaces fit accurately, and examines them to see that all diseased texture is removed. If the patella be diseased it must be dissected off, but if not diseased it should be left.

In cases of synovial disease the procedure is somewhat different. The semilunar incision should only divide the skin, fat, and fascia, and be reflected as a flap from the synovial swelling. The whole of the projecting diseased mass, including the patella, is then dissected off from above downwards, and from the sides. Thus the greatest portion of the diseased synovial structure is at once got rid of, and the joint fairly exposed; the lateral and crucial ligaments are then divided, and the other steps of the operation completed as already described. All portions of diseased synovial structure that can be safely dissected off should be removed, and the rest of the surface painted over with the chloride of zinc solution. This method may be adopted as the general method, or when there is much suppurative in the joint, so as to leave only healthy texture. In excision of the knee, after all the bleeding points had been secured, it used to be the practice to close the wound and put up the limb in the splint. But there is often troublesome oozing from the bone and from small vessels which do not bleed at the time of the operation, and hence I prefer merely to insert some points of suture without tying them, and to place the limb upon a temporary splint. If reactionary bleeding occur, the wound should be re-opened, and permanent adjustment of the limb delayed until twelve, or even twenty-four hours after the operation. When the bleeding from the section of the bone is very troublesome, I have sometimes found it necessary to interpose a flat pad of lint soaked in a solution of perchloride of iron or turpentine between the femur and tibia, to arrest the hæmorrhage. This has usually been quite effectual, the cases going on favourably afterwards.

The permanent adjustment and after-treatment of the limb require great care, with a view to which the selection of proper apparatus is important. In my earlier cases I used to employ the form of splint advised by the late Mr. Price, and the limb was kept fixed, the apparatus resting on the bed. Though the results of these cases were admirable, the treatment was very troublesome; and I feel convinced that for comfort to the patient, and for obtaining a good result with greatest ease, the apparatus should always be swung, so that the movements of the trunk may not injuriously affect the limb. Thus,

the patient can, after a few days, sit up in bed, and bed-sores are prevented. Price's splint is sometimes useful where we want counter-pressure on the sole of the foot, to maintain the tibia in firm contact with the femur in cases where the osseous union is slow in forming.

But, as a general method, I prefer the principle of and use, with some slight modifications, the simple and effective apparatus designed by my colleague Dr. Watson. "It consists essentially of two parts—1. A suspension-rod made of iron, about the size of No. V. of trade wire gauge; 2. A modelled Gooch splint, long enough to extend from the tuberosity of the ischium to beyond the heel.

"The suspension-rod extends from the groin to the extremities of the toes, and is bent to the outline of the limb, departing from it only in the situation of the excision, where it forms a bow or arch. To the upper surface of the rod are attached one or more hooks, by which the suspension is effected.

"The Gooch splint should not be made too wide, and should certainly not surround the thigh and leg to more than two-thirds of their circumference. It should be scooped away laterally, at a part corresponding to the site of the excision, and should have an aperture cut, corresponding to the tendo Achillis and heel. The inferior extremity of the splint is thus of a horse-shoe or stirrup shape, and admits of the ankle and foot being supported by the lateral horns of the splint, as they fold on each side of the malleoli, without the risk of inordinate pressure being made upon the tuberosity of the os calcis. In application, the limb is first laid and carefully adjusted upon the posterior splint, which should preliminarily be padded with lint, and covered with gutta-percha tissue, or hot paraffine, in the situation which corresponds to the site of operation. The iron rod is then placed in front, and folded lint between it and the limb at the groin (where the rod terminates above), at the upper part of the tibia, and at the bend of the ankle. These two parts of the apparatus are then retained in contact with the limb by means of an open-weave roller bandage applied from the toes upwards, the site of the incision alone being left uncovered. The whole is then rendered immovable either by means of plaster-of-Paris applied by the hand, of a consistence like thick cream, or of paraffine, which, having been rendered temporarily liquid by heat, is applied by a large paint-brush. When the application has solidified, the patient may then be removed to bed, and the limb suspended from the running pulley of a Salter's swinging cradle, or from the roof-bar of the common iron-wire cradle employed to support the weight of the bed-clothes. The foot and limb should not be much raised above the level of the mattress upon which the patient lies, as this is apt to lead to an awkward position of the limb when the patient first begins to move about."

In my own practice I generally use a wire splint with a narrow movable centre-piece corresponding to the knee, which can be lengthened or shortened so as to fit any patient, instead of the long Gooch's splint; and I omit the use of the plaster-of-Paris, or at least only use it at certain parts, to give firmness and solidity to these points from

which the apparatus is to be slung. I substitute broad strips of adhesive plaster in interrupted circles, to fix the apparatus to the foot, leg, and thigh, and then apply an ordinary roller round the foot and leg to a little above middle of the calf, and apply another roller from about four inches above the knee up to near the hip. The pelvic part of the splint is fixed with broad strips of plaster. If there be any tendency to projection or elevation of the condyloid end of the femur, a flat pad should be placed in front, and a separate circle of plaster or broad bandage applied over it and fixed behind the splint. My objection to the plaster-of-Paris bandage is that we cannot readily ascertain when deep-seated abscesses may be forming. In three cases in which I used it everything looked well at and near the wound; the patients complained of no pain, and it was only after discharge showed itself at the upper part of the apparatus, that abscess, burrowing under the muscles of the thigh, was detected. The modification I recommend allows of the bandage being cut or removed without disturbing the limb, as the broad circles of adhesive plaster retain the apparatus fixed until a clean bandage is applied. Besides, as swelling subsides, the gypsum bandage is liable to become loose and permit of motion between the ends of the bones. I would also advise a water instead of an air pillow as being more comfortable; but that is a matter of minor importance.

EXCISION OF THE ANKLE-JOINT.—This operation, which corresponds to excision of the wrist in the upper extremity, is, however, much less complicated and much more easily and rapidly performed. The bones which enter into the formation of the joint are only the lower extremities of the tibia and fibula, and upper head of the astragalus, which last is so defined that its resection can be accomplished without interfering either with the astragalo-scapoid or calcaneo-astragaloid articulations; whilst, as regards the tendons and bloodvessels, they are so arranged, and so loosely connected with the bones and joint in front and behind, as to be readily separated and drawn aside, to permit of resection being effected. My own experience of the operation is almost limited to cases of compound dislocations, in which I consider its performance is sometimes preferable to merely reducing the dislocation; and the ease with which the resection can in these instances be performed proves that in certain cases of disease it might be as easily effected with great advantage. But, unfortunately, the suitable cases are of rare occurrence, as the extent of the disease, and the implication of the surrounding textures, are very generally such as to necessitate amputation.

The best method of performing excision of the ankle is by means of two lateral incisions; one along the inner and posterior margin of the tibia, commencing about two or two and a half inches above the internal malleolus, and passing below the malleolus, curving round it and forwards towards the inner margin of the tendon of the tibialis anticus. The other incision is of the same extent and form, along the outer margin of the fibula, and should curve to the peroneus tertius tendon on the outside of the foot. The operator first carefully dissects

or separates the tendons of the peronei muscles from the fibula, till he can pass his finger well behind that bone. He then proceeds to separate the tibialis posticus and common flexor from the tibia along the line of the internal incision, and carefully clears the posterior aspect of the tibia and fibula above the joint, so that he can pass a narrow metallic spatula from one incision to the other, between bones and the soft parts placed posteriorly. The next step in the operation is to dissect forward the skin flaps marked out by the incisions, and separate the tendons, vessels, and other soft parts in front from the joint. In doing this, the edge of the knife should be constantly directed towards bones and joint, to secure the safety of the extensor tendons and anterior tibial artery, and also to disturb the connection of parts as little as possible. When this has been accomplished, a doubled fold of broad bandage is passed behind the soft parts, to enable the assistant to draw them forwards. The foot should now be forcibly inverted, to put the external lateral ligament on the stretch and render the external malleolus prominent: by cutting directly upon the point of the malleolus, from without inwards, the narrow attachment of the external lateral ligament is at once divided. Then, the margins of the inner incision being separated, the surgeon divides the narrow attachment of the internal lateral ligament on the point of the internal malleolus. The joint being thus opened, the foot is replaced, and held firmly at right angles to the bones of the leg. The soft parts are then held forcibly apart from the bones; the long narrow Langenbeck saw is passed between the posterior surface of the bones of the leg and the soft parts, which are protected by the metallic spatula; and the tibia and fibula sawn through from behind forwards, about an inch above the malleoli. As the malleolar fragments have already been separated from their ligamentous attachments, a few touches with the point of the knife suffice to separate any remaining attachments, and the resected fragments are removed, either by the internal or external incision. As the soft parts are held apart, and the foot fixed, the upper portion of the astragalus comes into view, and the projecting articular portion is sawn off. Should there be any difficulty in doing this, the foot should be twisted, so as to project the astragalus laterally, to allow the section to be made with the narrow saw. All portions of diseased or injured synovial structure should be removed, all bleeding vessels twisted or otherwise secured, and points of suture introduced, and either closed at the time or left to be secured when all oozing has ceased.

When there is much diseased synovial tissue, which cannot be dissected off, the surgeon should paint it over with a solution of chloride of zinc (1 part to 30). The limb is then placed on a light wire-splint, well padded and covered with gutta-percha tissue, secured and slung in the same manner as for compound fracture of the ankle, represented in plate VII., fig. 13, only, instead of bandages, broad strips of adhesive or soap plaster may be advantageously used to secure the limb to the splint, and the use of ice-bags must depend on the circumstances of each case.

In performing the operation in the diseased state it will be found much more simple than the description here given, as, owing to the

gelatinous degeneration the ligaments are softened or destroyed, and disarticulation is very readily accomplished. I had recently an opportunity of performing this excision on a child, with good recovery; but after a year the tibia and fibula had atrophied at the point of section, and fibrous union only had taken place. So that I think amputation at the ankle would have given a better result.

LECTURE LXXIII.

AMPUTATION: Ends sought to be attained by it: Best Modes of fulfilling these—Anatomy of Stumps—Growth of Bone after Amputation—Advantages and Disadvantages of various Forms of Flaps, as advocated by Liston, Syme, and others.

THERE are few operations which the surgeon is more frequently called on to perform than AMPUTATION, and none which require more consideration as to the best methods of operating, more care in the performance, and more attention in the after-treatment. Whilst, on the one hand, the term "Opprobrium of Surgery," is singularly unsuitable as applied to an operation, which, by removing a disorganised or worse than useless part, so often snatches the patient from the very jaws of death, and restores him to health and comparative enjoyment; on the other hand, as it is an operation which necessarily entails mutilation, the surgeon is bound to use his utmost endeavours not only to obviate the causes of danger to life but also to avoid those conditions which are likely to interfere with the future comfort of the patient. He must not only remove the limb with safety to the patient, but he must also avoid the production of a painful or irritable stump.

The formation of a good useful stump, effected with the least risk to life, being the object in view, the question to be decided is, What methods of operating enable us most surely and readily to attain it? Having had a very considerable experience in performing amputations, and having, from an early period of my professional life, paid great attention to the subject, I trust the following remarks, founded on the results of my personal investigations and experience with regard to the different modes of operating, may be of some practical service.

In deciding on the advantages or disadvantages of the different plans of operating, we must first determine what are the requisites of a "good stump." I believe these may be succinctly stated thus: that the bone be well covered with soft parts; that it shall not be adherent to, nor bear directly upon, the cicatrix; that the nerves be so cut as not to become involved in the cicatrix or attached to the end of the bone; and that they be so deeply covered as to obviate the bad effects produced on their cut extremities by pressure or atmospheric changes. A stump possessing these requisites will be able to bear a considerable amount of direct pressure, without becoming painful, irritable, or liable to ulceration.

Having fixed a standard, I now proceed to consider how far the various methods of amputation reach or fall short of it, and what is the best mode of attaining it. In considering the general principles I

shall take the amputation of the lower extremity, and specially that of the lower part of the thigh, as typical of the operation.

When I first entered the profession the methods of amputation then in general use were the flap operation by transfixion, and the old circular operation, as modified by Alanson. In Edinburgh the former method, characterised by great rapidity in its performance, and strongly advocated by Messrs. Liston and Syme, had so completely gained the ascendancy that I never saw the circular operation performed until I visited the hospitals of London and Paris. There I found most of the leading surgeons keen advocates for its employment, and denouncing the flap operation as being much more dangerous to life, and as leading ultimately to bad stumps. My own observations, tinged perhaps by some prejudices of education, led me to the conclusion that the flap method was decidedly the better; although a careful examination of results showed me that it did not possess all the advantages claimed for it. The chief objections I had heard urged against the flap operation by the advocates of the circular method, were first, that the redundancy of muscular tissue retained acted as a source of danger; secondly, that this tissue was useless as a covering, because it became atrophied, and in course of time disappeared altogether; and thirdly, that the manner in which the nerves were cut favoured the development of neuromata. With regard to the first of these objections, subsequent experience has shown me that it possesses much force. In order to determine how far the two latter assertions were correct I made a series of dissections, which included stumps formed by both methods of amputation. These dissections are now in the University Museum. As the result of these investigations, I may state, without entering into details, that, whilst the muscular substance retained in flap operations was observed to be diminished in bulk, the decrease in many cases had not occurred at all to the extent which *a priori* reasoning might lead us to expect. Thus, in a flap amputation of the leg, which I dissected twelve years after the operation, the portion of the gastrocnemius covering the end of the bone had scarcely undergone any change;¹ and in a dissection of a hip-joint stump, three years after the operation, the coarse muscular fasciculi of the gluteus were distinct and of natural appearance up to the very cicatrix; and in almost every case the muscular tissue, even when greatly altered in character, could still be traced as a thick fibrous layer under the integument. As regards the presence of neuromata, or enlargements on the extremities of the divided nerves, I found that these were equally present in all forms of stumps, and even when the nerves were deeply covered; that, in fact, a greater or less enlargement of the end of a nerve was a necessary consequence of its division.² From a careful examination, with low magnifying powers, of such neuromata in dissected stumps, and of those which I had removed from stumps in the living, I found that they consisted of consolidated lymph, deposited amongst the fibrillæ of the nerve; and, as explanatory of their origin, I think it probable, as I

ed in a notice of this subject before the Anatomical Society of Edinburgh, that when a nerve is divided the neurilemma retracts to a

¹ Plate XVIII., fig. 4.

² Plate XVIII., figs. 1, 2, and 3.

greater extent than the contained vessels, each, being thus set at liberty, spread out and separate from each other; that lymph is then effused in the spaces between them, and that the nerve filaments become attached to this lymph, and, as further effusion takes place, are stretched out upon it. When such swellings are subjected to irritation from pressure, or, being near the surface and scantily covered, are liable to atmospheric influence, or when they happen to have become involved in the cicatrix, they increase in size, and give origin to excessively painful symptoms; but, whether the stump has been a painful one or not, neuromata are invariably present on all the nerves of any size.

I may here also describe the appearances observed in the bones forming the skeleton of the stumps. At the point where they were sawn across, the surface had become rounded off, and the medullary canal was closed in by the effusion of new bone. They were also, in most cases, atrophied so as to appear more than naturally pointed; but in some instances they were enlarged, either generally or partially, by the deposition of osseous matter. In stumps of the forearm and leg the ends of the two bones were usually approximated and connected by a strong ligamentous substance, and in some cases they had even coalesced so as to form an osseous arch. In almost every instance the end of the bone corresponded to the cicatrix, and was often firmly united to it.

There is an interesting point in connection with this part of the subject to which I would further allude—namely, the growth of the bone after amputation in young persons, this growth giving rise to projection of the cicatrix and conical stump. Mr. Hargrave of Dublin long ago drew attention to this circumstance in his work on operative surgery; and my own observation leads me to believe that the bone may continue to grow in the young, and thereby tend to produce the results which have been mentioned, although, doubtless, this condition of stump may also be caused by other circumstances which come into play as the patient grows up. My own dissections do not furnish sufficient data on this point, but I have one preparation of so marked a kind that I cannot but refer to it. The case was one of amputation of the upper arm, performed by Mr. Liston; and in it not only does the bone project in an extreme degree, but it terminates in a hook-like process (plate XVIII., fig. 3). This could scarcely result merely from the retraction of the other tissues. The practical deduction to which this leads us is, that in performing amputation on the young we should leave rather a redundancy of soft parts, so as to obviate the effects of the osseous development.

These dissections, then, satisfied me, in the first place, that the muscular tissue preserved in stumps formed by the flap operation was useful in providing a thick layer or protecting pad, which did not disappear even after the lapse of many years; and, in the second place, that a certain degree of enlargement of the ends of the nerves in a stump was the inevitable consequence of their division, in whatever manner the operation was performed; the point to be attended to in regard to this being to cut them so high that they could not become involved in the cicatrix, or stretched over or adherent to the end of the bone, and

to have them so deeply covered as to be less liable to be affected by atmospheric changes or external pressure.

I was still further induced to give the preference to the flap operation by the condition in which I found those stumps that had been formed by the circular method. Nearly all of them that I examined were extremely conical, and had the bone adherent to the cicatrix, which latter was not unfrequently ulcerated; in the living subject, too, they were almost always excessively tender. At the same time, many of the stumps formed by the flap operation were very defective, and this was especially the case when the amputation had been performed according to the method of Vermeil, by lateral flaps in the lower third of the thigh. In such a stump the bone projected towards, and generally adhered to, the cicatrix at the anterior point of transfixion, whilst the soft parts forming the flaps hung back from it. In many cases both of lateral and antero-posterior flap operation I found the soft parts so retracted as closely to resemble stumps formed by the circular method, and in several the bone projected the cicatrix, whilst in others the flaps seemed to have turned in upon themselves, leaving a deep cleft corresponding to the cicatrix, which was closely attached to the bone. Still, as a general rule, the stumps resulting from the flap operation were decidedly better than those from the circular, and their defects apparently did not depend on causes inherent in the mode of operating; and, on the whole, this method appeared to combine greater rapidity and facility of execution, with the formation of a more thickly-covered stump.

The plan which I adopted in my earlier operations was that by anterior and posterior flaps, as recommended by Mr. Liston. The flaps were made by transfixion, the one in front being rather short, whilst the one behind was considerably longer, in order to allow for the greater retraction of the posterior muscles. The flaps were then pulled well back, and the bone cleared by circular sweeps of the knife before applying the saw. Thus, when the operation was concluded, the result was two rounded flaps of equal length, with the bone cut through a little higher up than their bases. Nothing can look finer than this at the time. The smoothly-cut flaps come neatly together, and cover the bone thickly, so as to form a well-rounded stump. Practical experience, however, soon showed me that in order to obtain a permanently well-covered stump, it would not do to trust to flaps formed in this manner, as they had a tendency to retract gradually to the point of transfixion; and if, in order to remedy this defect, they were cut very long, they contracted and turned in upon themselves, and left a deep cleft in the line of the cicatrix, so that the cushion of soft parts did not correspond to or cover the end of the bone. Seeing, then, that merely adding to the length of the flaps did not produce the result which was desired, I was led to make an alteration in the method of operating itself. I transfixed the limb fully two inches lower down than where I intended sawing through the bone, and having cut and retracted the flaps, I applied the point of the knife round the bone so as to clear it upwards to the extent of two inches already specified. The limb was now raised in order to project the bone away from the

soft parts, and the saw was then applied as high as possible. By this means the bone remained deeply covered even after permanent contraction of the stump had taken place, because, although flaps may retract up to the line of their bases, they cannot do so beyond it, and by such a mode of amputating as has been described the bone was cut through a long way above the base of the flaps.

I still further modified my plan of operating by making the anterior flap the longer of the two, instead of the posterior, as recommended by Mr. Liston. That great surgeon, when speaking of antero-posterior flaps in the thigh, urges, as one of their advantages, that "the more the stump is raised the better is the end of the bone covered—the anterior flap folds over it." Examination, however, has shown me that, in stumps formed according to Mr. Liston's method, the bone is never fully covered by the anterior flap; and indeed it will be obvious to any one, that the mode of balancing the flaps by cutting the posterior longer, so as to allow for its greater retraction, must necessarily make the line of cicatrix pass through the centre of the end of the stump, and so correspond to the extremity of the bone. By cutting the anterior flap, however, rather longer than the posterior, two unequal flaps will result; the anterior will then "fold over the end of the bone," and the cicatrix will be posterior to the centre of the stump. Another advantage which arises from this plan of operating is, the greater simplicity of the dressing and after-treatment, owing to the diminution in the bulk and weight of the posterior flap. I continued to practise the double-flap operation thus modified, and to teach it in my surgical lectures up to a very recent period; and from the results I obtained I was satisfied that it did not leave much to be desired as regarded the form of stump; and in some parts of the limbs, and under certain circumstances, it is that which I still recommend and adopt. It, however, requires great care in its performance, and in some cases is attended with much difficulty. As examples of such cases, I may especially refer to two of not uncommon occurrence—namely, primary amputations, and amputations through condensed textures, as in the vicinity of necrosed bones. In the former, when amputation is performed on a healthy man, it is almost impossible to avoid a redundancy of muscular tissue, and this not only prevents the integuments coming readily together but also causes the section of the bone high up to be a matter of great difficulty. In the latter the densely consolidated, almost cartilaginous, tissues composing the flaps, cannot be retracted so as to allow the bone to be cleared and sawn through sufficiently far above the point of transfixion, and therefore, in such cases, this plan of operating cannot be properly executed. To get rid of the redundant muscle in primary amputations, and more especially in amputations below the knee, I used to slice off a portion of the muscle after the flap was formed; and this, although a somewhat awkward-looking procedure, made a better stump.

In 1846, Mr. Syme, whose writings and practice had done so much to introduce and promote flap amputation in this country, took occasion to state, in a paper on amputation of the thigh (*Edinburgh Monthly Journal of Medical Science*, 1846), that his experience had led him to modify his opinions to the advantages of flap amputation, and to

I recommend as preferable, in the lower third of the thigh, a modification of the circular method. This consisted in making two semilunar incisions through the integuments, which are dissected and retracted upwards for at least two inches, then cutting the muscles on a level with the retracted skin obliquely up towards the bone, the muscles on the posterior aspect being divided somewhat lower down than those on the anterior. All the soft textures are then forcibly retracted, and the bone cleared and sawn high up. This plan of operation, when it is well performed, and when care is taken to leave a sufficiency of soft parts, gives excellent results, and is especially applicable to primary amputations. I have repeatedly operated by this method in such cases, and also in others; and although at first prejudiced against it, I have no hesitation in saying that in primary cases, at least, it is superior to the ordinary double-flap operation by transfixion, both as involving less risk to life and as forming a better stump. In several cases, also, I have practised the ordinary circular amputation with the same successful results. But whilst I was thus led to recognise the advantages of the circular, or modified circular, method in primary and certain other amputations, yet in ordinary cases of disease of the knee, where the muscular tissue was not redundant, I continued to practise the modified double-flap operation formerly described, because, where the circular method was employed, the muscles, owing to the way in which they were divided, retracted, and did not heal over the end of the bone. The only covering for the stump, therefore, was the skin and subcutaneous fatty layer, which latter, in cases of chronic disease, is apt to be very scanty. Mr. Syme, indeed, supposes that there is a mistake in regard to preserving muscular tissue, and thinks that skin is the proper covering for a stump. In the paper already referred to, he says—"The perfect condition of stump resulting from amputation at the ankle, where there is nothing but integument to protect the bone, led me to conclude that if the circular operation could be performed with the certainty of producing such a covering, it might be employed with advantage in the lower third of the thigh, which being the thinnest part of the limb, more readily admits of forming a stump composed merely of skin." There is, however, a fallacy in this, arising from the idea that in the ankle-amputation there is nothing but integument to protect the bone. The protective covering in that amputation is altogether peculiar, consisting, as it does, not merely of skin and ordinary subcutaneous fat, but of a peculiar elastic cushion of fat and fibrous tissue, specially arranged and adapted by nature for bearing direct pressure. If, indeed, we could, as Mr. Syme observes, obtain such a covering in other situations, it would undoubtedly be superior to all others, but unfortunately in no other amputation can we obtain it; and as the dissections of old stumps have shown me that the muscular tissue retained does form a protective covering more or less thick, I still think that if we can preserve it in moderate amount, and in such a position as fairly to cover the end of the bone, we shall then have a better stump than when we trust entirely to skin.

LECTURE LXXIV.

Amputation continued—Mr. Teale's Method, by a Long Anterior and Short Posterior Flap: its Advantages and Disadvantages—The Author's Method, by Long Anterior Flap—Mr. Carden's Method.

IN 1858 the late Mr. Teale of Leeds published an account of his method of amputation by a long and a short rectangular flap. The mode of performing the operation, and the objects proposed to be attained, may be given in Mr. Teale's own words. "To procure a more useful stump, and in the hope of somewhat diminishing the mortality of the operation, it is proposed to amputate by a long and a short rectangular flap; the long flap, folding over the end of the bone, being formed of parts generally devoid of large bloodvessels and nerves, whilst these important structures are contained in the short flap.

"The size of the long flap is determined by the circumference of the limb at the place of amputation, its length and its breadth being each equal to half the circumference. The long flap is therefore a perfect square, and is long enough to fall easily over the end of the bone. In selecting the structures for its formation, such parts must be taken as do not contain the larger bloodvessels and nerves. A flap so formed will be for the most part anterior in position, as far as regards the general aspect of the body, but superior when the patient is in the recumbent position, as during the after-treatment. The short flap, containing the chief vessels and nerves, is in length one-fourth of the other. The flaps being formed, the bone sawn, and the arteries tied, the long flap is folded over the end of the bone; each of its free angles is then fixed by suture to the corresponding free angle of the short flap. One or two more sutures complete the transverse line of union of the flaps. At each side the short flap is united to the corresponding portion of the long one by a point of suture, and one suture more unites the reflected portion of the long flap to its unreflected portion. Thus the transverse line of union is bounded at each end by a short lateral line at right angles to it."

Before investigating the merits of this method, we may observe that amputation by a long anterior and a short posterior flap is not a new operation. In 1765 Mr. O'Halloran of Limerick recommended, and carefully described, such a method for amputation of the thigh. His directions are as follows:—"With a straight knife commence your flap incision at about three inches more anteriorly (lower down?) than where the bone is to be sawn through, supposing an adult, and so in proportion to the age of the patient and the size of the limb. Let the incision

be continued in an oblique direction till you reach the bone, then, with the same, or a common amputation knife, make your circular sweep, commencing from the side of your flap, directly to the bone." Mr. O'Halloran, however, had peculiar views as to dressing his stumps. He inserted a piece of lint between the bone and the flap, dressing the surfaces separately for ten or twelve days before approximating them. In 1848 this method of amputation was revived in France by M. Sedillot, and also by M. Baudens; the former surgeon, even in his mode of dressing, closely following O'Halloran, by directing a piece of lint or other digestive to be interposed between the bone and the flap for some days. On consideration it will be seen that the anterior flap, recommended by Mr. O'Halloran, is far too short. For, taking the thigh as nearly a circle, and twelve inches as an average circumference, the flap would be less by one inch than the diameter of the limb, or the surface which it has to cover. This, along with the peculiar mode of dressing the stump, was probably the cause of the operation falling into disuse.

Mr. Teale's method of amputation possesses the great advantage of having the end of the bone completely covered by the sound tissue of the anterior flap whilst the cicatrix is placed high up on the posterior aspect of the stump. It, however, has certain disadvantages. The excessive length and square form of the anterior flap are, in themselves, serious drawbacks to the operation. Moreover, as the angles of the anterior flap require to be brought into exact apposition with those of the posterior, the anterior flap must be doubled on itself. When retained in this position by stitches, its vitality is placed in some risk, and if union by first intention do not occur, the reflected portion of the flap is apt to fall away from the unreflected portion, thereby causing trouble in the after-dressing of the stump.

In 1858 I began to practise a mode of amputation which has yielded excellent results, and which in certain situations, as for example in the lower part of the thigh, I now employ in preference to any other operation that I have hitherto tried. The method which I adopt is that of a long anterior flap, but this is formed on a principle essentially different from that which regulates the construction of the flap in the operations of O'Halloran, Sedillot, and Baudens, and is a material variation and simplification of Mr. Teale's method. In carrying out directions of Mr. Teale, it is absolutely necessary, as was previously observed, that the angles of the anterior flap be brought into exact apposition with those of the posterior. The anterior flap must therefore be doubled on itself, and in order to admit of this, its length must be equal to one-half of the circumference of the limb, so that in a thigh twelve inches in circumference, if we do not obtain an anterior flap at least six inches long, the operation cannot be accomplished. In the method of amputation which I employ, the anterior flap is not formed with the design of being doubled on itself, but is simply made of such a size and shape as will allow it to fold loosely over and cover the posterior segment of the stump. For this it is necessary that the flap, throughout its extent, be in breadth fully equal to one-half the circumference of the limb, and that it be gently rounded at the extremity, so as to adjust readily to the curve of the cut margin of the posterior half of the stump, whilst it must be sufficiently long not merely to cover,

but to hang loosely over, the posterior cut surface, so that the cicatrix may be placed ultimately on the posterior aspect of the thigh, and without the flap being tensely stretched over the end of the bone. In my own operations I judge of the proportion by the eye, but a flap of four inches would be found sufficient in a limb twelve inches in circumference. The soft parts on the posterior aspect of the limb are divided obliquely towards the bone, the incision beginning three inches lower than the level of the base of the anterior flap. Due attention must be paid to the mode of preparing the bone for section. The thigh should be somewhat elevated towards the pelvis, the soft parts slightly retracted, and the bone cleared two inches higher up than the base of the flap. By elevating the thigh, the bone is projected to the utmost, and if sawn close to the soft parts, it will be found, on the limb being lowered, to be deeply buried, and the anterior flap hangs loosely over it.

In regard to the textures composing the flap.—I generally operate as low down as possible, the lower margin of the anterior flap being on a level with or below the patella, so that the lower part of the flap is chiefly composed of skin; but then I cut obliquely upwards through the anterior muscles to the bone, immediately above the condyles, so as to have a thicker cushion of texture directly corresponding to the sawn end of the bone. Lastly, the great vessels must be left in the posterior part of the stump, and not included in the long flap. Keeping these points in view, the operation may be briefly described thus:—Supposing that the right thigh is to be amputated, the surgeon, placed on the inner side of the limb (so as to be able to grasp the distal portion of bone when sawing), inserts his knife deeply, pretty far back on the outside of the thigh and about three inches above the patella. He then carries the knife downwards through the skin and fascia to below the lower edge of the patella, and after cutting, with a gentle curve, across the front of the limb, he carries the incision up the inside of the thigh, to a point opposite the place where he commenced it. Whilst he is making the incision his assistant retracts the skin and fascia, and when, by a few touches with the knife, the muscular tissue of the thigh attached to the upper margin of the patella is exposed, the surgeon cuts obliquely through it to the bone; then applying the edge of knife to the soft parts on the posterior aspect of the limb, at least three inches lower than the level of the base of his anterior flap, he cuts them with a sweep obliquely to the bone. Of late years I make this posterior short flap more convex than I formerly did, and dissect back the skin from the muscles for about an inch before dividing the latter, so as to prevent undue retraction of the flap. The assistant next retracts the soft parts, whilst the surgeon clears the bone by a circular movement with the point of his knife. The femur then being elevated so as to project it fully, is sawn through close to the soft parts, immediately above its condyles, or through the upper part of its condyloid portion. The femoral artery is very easily seen, towards the inner side of the posterior section of the stump, and when it and other bleeding vessels are secured, the flap is allowed to fold over the face of the stump, and is then adjusted and retained by sutures. (See plate XIX.)

This plan of amputation possesses all the advantages of Mr. Teale's

method, without requiring the troublesome adjustment of the angles of the square flaps, or the doubling back of the anterior flap upon itself. Nor does the anterior flap require to be of the excessive length which is necessary in that surgeon's operation. The after-dressing is also simplified, for if union by first intention does not occur, the flap, by its own weight, naturally tends to keep in position. Another important distinction consists in the bone being sawn through higher up than the base of the flap. A flap, however long, does not afford that deep, permanent covering, which results when the bone is buried amongst the textures, beyond the base of the flap, after being cleared by Alanson's method, whilst the exposed cut surface is also less.

In 1863 Mr. Carden of Worcester published an account of his method of amputation by single anterior flap, composed entirely of skin. The form and position of the flap are very similar to those of my method, but the base of the flap is not quite so high up, as Mr. Carden saws through the condyles of the femur, and, as I have said, the flap is composed entirely of skin. I have performed several operations by this method, and seen many stumps formed by it, but these have all been decidedly inferior to those formed either by Teale's operation or my own, being wanting in thickness of soft parts over the end of the bone. In some cases I know the bone has caused ulceration of the part of the flap corresponding to it, and subsequent adhesion to the bone. In some cases, also, I believe, great trouble has been caused by continued oozing, and even smart hæmorrhage, from the cut surface of the condyles; whilst, from what I have seen, I do not think the results show this method to be less dangerous to life than the other, in which the bone is sawn through immediately above the condyles, and a moderate amount of muscle preserved to form a protective cushion for it.

In a paper on amputation by Professor Lister, in Holmes' *System of Surgery*, I observe that in speaking of my plan of amputation, whilst he admits some of its advantages, he seems to think that it still involves the necessity of amputating higher in the thigh in order to procure a sufficiently long anterior flap. Now, what I consider to be one of the great advantages of the operation is, that it enables us to amputate lower in the thigh than we can do if we employ the double-flap method; for, as that part of the flap which is to be behind the bone does not require to contain muscular tissue, we are enabled to cut the flap as low down as below the margin of the patella.

Although convinced of the advantages of the single-flap operation at the lower third of the thigh, I would not sacrifice any extent of the limb merely to obtain a long anterior flap: and, as Professor Lister had seen several of my cases, he might have noticed that the stumps were all much longer than when made by the ordinary flap method. The method which Mr. Lister proposes of an anterior flap somewhat longer than usual; and a shorter posterior flap, is in fact my modification of Liston's double-flap operation, which I had long taught and practised, and which, in a previous part of these Lectures, I have fully described. This modification I still prefer in certain cases, but, after considerable experience of both plans, I have abandoned it, as a general rule, in favour of the method by a long anterior flap.

In other amputations, as in those of the arm and forearm, whilst the single flap is advisable it has fewer advantages. From the form of the limb, and its position when the patient is lying in bed, the flap does not adapt itself, by its own form and weight, to the cut surface, but, being placed more or less laterally, requires to be retained in position. In these situations a modification of it answers sufficiently well. In the upper arm a stump formed by a single flap from the outer and anterior aspect of the limb, the inner aspect being divided circularly a little below the level of the base of the flap, possesses the advantage of having the great nerves divided high up, and so removed from the end of the bone, which is covered by a good cushion of soft parts. The cicatrix is also placed high up on the inner side, beyond all risk of pressure. In amputation at the shoulder-joint, the method I prefer is also that by a single flap, cut in a particular direction. As a general rule, and for the reasons already advanced, I consider the single flap preferable, as forming a better covering of sound textures, and removing the cicatrix from pressure; but in certain amputations, and in particular circumstances, a modification of it, or two equal flaps, may answer better. Thus, in cases of amputation for malignant growths, I would advise the modified circular method, or two equal short flaps principally composed of skin, because in such cases we desire to avoid having any part of the flap cut from near the tumour, and the muscular tissue should be largely removed, being liable to contain proliferous cells, even at some distance from the growth, and a long flap of skin, from which the subjacent muscles have been dissected, has its vascular supply impaired and is very apt to slough. Again, in certain situations, as in some amputations of the foot, the position of the cicatrix in reference to the direction of the pressure of the boot, requires to be considered; and, finally, I need hardly remark that in cases of injury we cannot select our method of operating, but must modify it according to circumstances.

RULES FOR FORMATION OF A GOOD STUMP.

1. That the bone be well covered with soft parts.
2. That it shall not be adherent to, nor bear directly upon, the cicatrix.
3. That the nerves be so cut as not to become involved in the cicatrix or attached to the end of the bone.
4. And that they be so deeply covered as to obviate the bad effects produced on their cut extremities by pressure or atmospheric changes.

The method by which such a stump can be formed may, in general terms, be stated to be—by two flaps of unequal length. The longer flap should contain a moderate amount of muscle where it corresponds to the end of the bone, and should be cut from such a position that it will fall over the end of the bone. Owing to the inequality of the flaps, the cicatrix is drawn away from the bone. As a general rule, the long flap should not contain the larger vessels and nerves, but in the leg, where the thin integuments do not form a good covering, the long posterior flap is preferable, and, as the vessels and nerves are cut high up, there is less objection.

In all cases the nerves should be drawn out and cut short, to avoid their being included in the cicatrix, or becoming adherent to the bone.

In certain cases, as in the case of malignant tumours, where it is desirable to remove as much muscular substance as possible, a long thin flap is apt to slough, and therefore two short equal flaps of skin are preferable.

LECTURE LXXV.

Amputation continued—Prevention of Hæmorrhage during the Operation, and its Arrestment afterwards—Immediate and After-treatment of Stumps.

As regards the arrestment of hæmorrhage in amputation, we have, first, to attend to the temporary bleeding during an operation ; and, secondly, its permanent arrestment after the operation.

In the great amputations in private, and also in hospital practice, the ordinary tourniquet and Esmarch's bloodless plan are the safest methods for arresting bleeding during the operation. At one time the tourniquet was objected to as entailing a larger loss of venous blood than necessary ; but this is rather a theoretical than a practical objection, and has been already fully discussed in a former Lecture (XXXIV). In an cedematous limb the tourniquet is very apt to get slack as the serous fluid escapes, and therefore the circular india-rubber compressor may be used to prevent any loss of blood. It is better in some cases to compress the main artery by means of the fingers, if we have a good assistant, for this does not interfere with the retraction of the muscles. When the tourniquet or other circular compressor is used the muscles are prevented from retracting to their full extent at the time, and on removing the circular compression they retract very quickly, and we find that the bone projects more than we expected. In the case of the femoral artery, the compression should always be on the brim of the pelvis, and never on the femoral artery in the thigh, for by the former method we get complete command over the vessel. The brachial artery should always be compressed very high up, just where the axillary artery ends, no matter at what part of the arm we are going to amputate, because the brachial artery in the middle of the arm is very movable ; and if it slips from under the assistant's fingers it is often difficult to get it compressed again.

The permanent arrestment of hæmorrhage is effected in the usual way, by ligature or by acupressure. In using the ligature the vessels are drawn out and tied close to the soft parts ; the loop of the ligature should always be passed over the point of the artery forceps before being at all tightened, and the vessel should be tied as far from the forceps, and as near the soft parts of the stump as possible. If any small branches are seen coming off from a large artery, the vessel should be dissected up a little, and tied above the point where the branches come off.

The after-treatment of the stump may be said to be the same as that of an incised wound, though practically it is not a simple incised wound, but a very large cut surface, including all the various soft textures of the limb, and having at its deepest part either a section of

the bone or an articular surface. When we reflect on the various degrees of vitality, and therefore of reparative power, in the different textures forming the stump, we can scarcely expect all these textures to heal exactly in the same time or in the same way. Those endowed with much vitality, such as the skin, cellular tissue, and muscles, are generally united very soon, while the tendons and the osseous textures are undergoing slower processes of healing and alteration in form. In the case of the denser and less highly vitalised tissues, the amount and extent of action which follows the operation, whilst it may not be excessive for the softer tissues, may yet prove too much for the vitality of the denser textures; and portions of fascial or tendinous tissue, instead of healing, may slough. The bone, too, requires to be rounded off, and during that process, in a very dense bone or after primary amputation, we may have slight molecular necrosis taking place, and abscesses forming from time to time as these minute portions separate. Great exfoliations of the bone are not very common now-a-days, and even acute necrosis, after primary amputation, is not very frequent, but slight molecular necrosis is not uncommon from the bone rounding off; its denser texture, instead of opening out and yielding, dies under the excited action; there is, in fact, a slower process of alteration and healing in the denser than in the softer textures.

Again, as regards the state of the parts in which we amputate. When we amputate for a diseased knee-joint, for example, we very often have to cut through abscesses and other textures, which are so far unhealthy, and require local applications, and which cannot therefore be expected to heal by the first intention. Absolute and complete primary union cannot, therefore, be often expected; but, under ordinary circumstances, we find that a very large proportion, if not the whole, of the stump does heal by adhesive action, portions here and there not being so united, and this is generally due to the character of the textures entering into its formation.

The simple plan of dressing incised wounds was first applied by Mr. Liston to the treatment of stumps. His rule used to be to tie the vessels and wash the flaps, laying the latter in contact; the patient was then removed to bed, and cold water was applied for six or eight hours, till the oozing ceased and a layer of lymph was thrown out on the surface; then the edges of the wound were brought together by sutures. The object of this was to get rid of all oozing and clots of blood, and to let the surface of the wound glaze by effusion of lymph; the plastic surfaces were then brought together, and the water-dressings were continued, along with slight compression by a bandage. This plan looked very well in theory, but in practice it did not answer. It was found that the stumps did not heal readily; the flaps, lying loose, were disturbed by every movement of the limb, and this caused more oozing than would otherwise have happened. This plan was therefore soon given up, as it was found to be very inconvenient. The application of cold was beneficial, no doubt, but this should never be carried beyond a certain point, as it may induce a low form of inflammation in the stump, unless it be applied in the form of dry cold by means of ice, which seemed to answer well in the practice of Langenbeck and others, in the late war in Schleswig-Holstein.

In dressing stumps after the amputation, I first wash the cut surfaces thoroughly, by pouring a full stream of tepid carbolic water over them, and sponge away all clots. Then the flaps, being brought into accurate apposition, are united by silver or catgut sutures, leaving a dependent point open for escapes of serous or bloody discharges. Again the surface of the stump is sponged clean and dressed in one or other of the following methods: First, when the parts composing the flaps are healthy, and likely to unite readily, I take a broad slip of lint soaked in boracic acid lotion, and apply it over the end of the stump so as to cover its surface completely, and then secure this, and afford support to the flaps by encircling the stump with a narrower slip of lint, also soaked in boracic solution; when this circular slip is fixed, by drawing upon the ends of the other piece of lint, firm support is given to the stump, and if this dressing be kept moistened with the boracic wash, it need not be removed for forty-eight hours, unless bleeding or tension occur. The stump is then laid on the Mackintosh cloth and fixed, by means of a bandage pinned across it, to the bed; or I apply a broad piece of waxed paper next the skin, and then a single ply of lint is brought over the end, so as to support the flaps, and this is kept from slipping, and at the same time lateral support is given to the stump by means of a fold of lint encircling the stump, and containing a layer of oakum between its folds. In order to give more thorough support to the flaps, and prevent them retracting, a bandage applied from above down may be used before the dressing is put on. The stump is laid on oakum, and oakum is put loosely over the end, and if this dressing be properly applied, the stump can be looked at without raising it from the bed. In the evening, after the operation, the wound is syringed out, and all clots removed, a stitch being taken out at the angles of the wound if necessary, to allow of this being done. Great care is always taken that the discharge gets freely away; and for this purpose some stitches are removed at the most dependent part of the wound very soon after an operation. By this means the serous discharge at first, and subsequently any pus which forms, gets free vent, and bagging of the end of a stump, or abscess in the limb above, is prevented. A small piece of drainage-tubing introduced between the edges of the wound still further favours discharge by keeping the lips from closing at that part. Or, lastly, the open method may be used. In this the stump should be placed on a soft pillow, with a sheet of gutta-percha or Mackintosh cloth under it, and a piece of lint wetted with boracic or weak carbolic lotion is laid over the surface like a veil, and then a wire cradle placed over it to keep off the weight of the bed-clothes. In many cases, indeed, we may dispense with the lint, and leave the stump without any dressing, and merely covered by the bed-clothes. In the double flap and circular amputations we require to place pads of lint on the stump, so as to keep the surfaces together; but in the single-flap operation the flap remains naturally in position.

At the time the last edition of this work was published I was in the habit of using the methods of dressing above described, and they answered well, but further experience has led me to abandon moist dressings, and to revert to a modification of the open method, which at one time I used with very great success. The dressings which I now

use in amputations are either the antiseptic, which I have been testing of late, or the modification of the open method alluded to above. The latter plan is carried out as follows :—

Suppose an amputation of the thigh. After the operation is completed and the drainage-tube inserted, the stump is laid upon a Gooch's splint, padded and covered with gutta-percha tissue, and fastened to the splint by a turn of carbolised gauze bandage ; the end of the stump and the drainage-tube should project a little beyond the end of the splint. The patient is then laid on a mattress, about one-third of which has been cut away on the side corresponding to the amputated limb. The stump is then swung from a cradle with the point dependent, and under it a plate containing a strong solution of carbolic acid or chloride of zinc receives the blood or other discharges as they fall from the wound. The cradle is covered with a veil of gauze.

Thus no textile fabric is in contact with the wound, and, as the stump is slung, all discharges drain away at once into the plate, and are there acted on by the antiseptic fluid. As no manipulation beyond lightly touching the cicatrix with a moist camel-hair pencil occasionally is required, perfect rest is ensured.

In amputation through diseased textures, as for scrofulous joints, when the remains of the pyogenic membranes of abscesses are present, I have found much benefit from the use of tincture of iodine. It destroys the pyogenic membrane, and prevents suppuration from taking place to a great extent, so much so, that I used also to apply it to healthy flaps, with a view to prevent great suppuration. The solution of chloride of zinc I have also used with advantage, and still use it, especially in after amputations for malignant tumours.

If we attempt to force the union by compression, instead of advancing we are very likely to hinder it, and to cause strangulation and gangrene at certain parts of the stump. Long ago different forms of apparatus—plates of metal or wood—were used for keeping the surfaces of the flaps in very accurate contact, and preventing blood collecting between the flaps ; but this only serves to irritate the parts, and is therefore to be avoided.

At one time there used to be a great dispute regarding the form in which the edges of the stump ought to be brought together. It was disputed whether, in the circular amputation, the wound should be brought together perpendicularly or transversely ; the advocates of the former view showed that, by this plan, when the stump rested on a pillow, the lower part naturally tended to be pressed upon, and so the fluids from the stump could escape readily, while if the opening were transverse, there was no ready escape for the matter. The fact is, that both in the circular and double flap amputations, when the cicatrix is transverse, the wound lies obliquely, owing to the form of the limb, so that in reality there is a dependent opening at one side, just as much as if the line of incision were perpendicular.

THE CONSTITUTIONAL AFTER-TREATMENT must be conducted on the general principles already laid down in regard to the after-treatment of all great operations ; modified, of course, in individual cases, by the peculiarities of the case or the idiosyncrasy of the patient.

LECTURE LXXVI.

Amputation continued—Causes of Mortality—Statistics—Circumstances modifying the Value of the Information derived from them—Table exhibiting the Results of Author's Practice—Comments on and Deductions made from them.

THE consideration of the causes of the mortality after amputation is a subject so wide that I cannot be expected to enter fully on it, in all its phases, in a course of Lectures such as this, where so many subjects demand our attention. I will therefore confine myself to treating of it from certain points of view, which, from my own experience, I believe to have practical bearings.

Of late years much has been written on this subject, and large statistics have been published, from which certain general deductions may be drawn ;—the most usual deduction being that amputations of the limbs are very dangerous operations, and those of the lower extremity specially fatal.

Now, for my own part, I cannot see any great benefit to be derived from this kind of information, unless it be intended to indicate the propriety of abandoning the operation. However desirable it may be to possess the data established by such statistics, I think it might have been predicted that in such an operation as amputation, an operation of last resort, and performed often under most unfavourable circumstances, the mortality would be great ; and yet I should think such considerations would not deter any man of sense and experience from performing an operation which gives the only reasonable chance for life. But what I do consider to be of practical importance is to ascertain how far the operation in itself is necessarily of great danger or whether the dangers are greatly due to circumstances under which it is performed. It is quite possible that the statistics of an operation, not dangerous in itself, may show results very startling in regard to the amount of mortality attending its performance, due to the circumstances under which it is performed. The operation for strangulated hernia is an example of this. That operation is, I believe, attended with no danger in itself : the causes of death are invariably to be found in the state of the abdominal viscera antecedent to the operation ; and the tables of mortality are swelled by undue delay in operating. The same thing, indeed, cannot be said of amputation, for it has inherent dangers ; but I believe many circumstances which determine the favourable or unfavourable result are to be found in the different circumstances under which it is performed.

The statistics of amputation have been rendered of practical service in reference to the question of primary and secondary amputations, because they have been made comparative; and the results have established this great practical fact, that however great the mortality may be in primary amputation, delay in similar cases of injury, with a view to secondary amputation, is still more fatal. Hence, the surgeon feels that, when the case is one presenting no reasonable chance of recovery without amputation, he gives his patient the best chance by performing the operation at once. Little, however, has been hitherto done in comparing the immediate results of amputations performed for different diseases. Indeed, the usual tabulated form in statistics of amputation is *Primary, Secondary, and for Disease*; and thus, I believe, much valuable information is lost. Moreover, I think that more useful information would be obtained from statistics of the results of the practice of individual operators, with remarks as to any peculiar circumstances in the cases, and stating the nature and site of the injury or disease for which the amputation was performed, than from the larger general statistics at present referred to. It may be objected that the experience of any one man is too small for purposes of generalisation, but the aggregate of such statistical returns would give the general result—the operative procedure by the same surgeon would give equality in that respect; whilst we would obtain details which, I believe, would have most important effects on practice. In my own practice, both in hospital and private, I have kept such a record of the greater amputations which I have performed, and I shall now use it in trying to ascertain, or at least suggest, what are some of the causes influencing the results of amputation. My experience in performing amputation, though necessarily small in comparison with general statistics, is yet, I think, sufficiently large to entitle me to form some opinions on this subject; and I give them to you, along with some suggestions to assist you to elaborate the subject more fully with your own experience in practice hereafter.

The following tables exclude all amputations of less magnitude than those at the wrist and ankle joints. The first or general table gives the results of 503 amputations for all causes, and the information it affords is of the usual kind—namely, that out of a given number of cases of amputation so many recover and so many die. The subsequent tables show the results of the different amputations I have performed, under the heads of primary, secondary, and for disease; the last head being subdivided, so as to indicate the results of the operation in different diseases, and according to the situation of the disease. A glance at the results of amputations performed for different forms of disease will suggest the object I have in view,—to try to ascertain the probable causes of the greater mortality in certain cases, and how far these dangers are avoidable, or may be lessened.

As in the case of excisions, I have thought it best to keep the statistics given in the first edition of this work separate from those of the operations which I have since performed.

TABLES showing RESULTS OF AMPUTATION.

TABLE I.—GENERAL RESULTS up to 1870.

LOWER EXTREMITY.				No.	Recovered.	Died.
Hip-Joint	.	.	.	9	3	6
Thigh	.	.	.	155	100	55
Knee-Joint	.	.	.	1	0	1
Leg	.	.	.	53	37	16
Ankle	.	.	.	82	76	6
				300	216	84
UPPER EXTREMITY.						
Shoulder-Joint	.	.	.	23	17	6
Arm	.	.	.	33	21	12
Forearm	.	.	.	43	35	8
Wrist-Joint	.	.	.	4	4	0
				103	77	26
Total Upper Extremity	.	.	.	103		
„ Lower	„	.	.	300		
				403	293	110

GENERAL RESULTS from 1870 to 1875.

I. LOWER EXTREMITY.				No.	Recovered.	Died
Hip-Joint	.	.	.	2	2	0
Thigh	.	.	.	35	23	12
Knee-Joint	.	.	.	3	2	1
Leg	.	.	.	11	9	2
Ankle	.	.	.	27	23	4
Total	.	.	.	78	59	19
II. UPPER EXTREMITY.						
Shoulder-Joint	.	.	.	8	3	5
Arm	.	.	.	6	3	3
Elbow-Joint	.	.	.	2	1	1
Forearm	.	.	.	5	2	3
Wrist	.	.	.	1	1	0
				22	10	12
Total Amputations, 1870-75	.	.	.	100	69	31
Grand Total	.	.	.	503	362	141

GENERAL RESULTS from 1875 to March 1882.

LOWER EXTREMITY.					No.	Recovered.	Died.
Hip-Joint	.	.	.	.	4	2	2
Thigh	.	.	.	.	31	23	8
Knee-Joint	.	.	.	.	1	0	1
Leg	.	.	.	.	19	17	2
Ankle	.	.	.	.	28	25	3
					<u>83</u>	<u>67</u>	<u>16</u>
UPPER EXTREMITY.							
Shoulder	.	.	.	.	3	2	1
Arm	.	.	.	.	17	14	3
Forearm	.	.	.	.	3	2	1
Wrist-Joint	.	.	.	.	0	0	0
					<u>23</u>	<u>18</u>	
Total Upper Extremity	.	.	.	.	23		
„ Lower „	.	.	.	.	83		
					<u>106</u>	<u>85</u>	<u>21</u>

COMBINED GENERAL RESULTS to March 1882.

LOWER EXTREMITY.					No.	Recovered.	Died
Hip-Joint	.	.	.	.	15	7	8
Thigh	.	.	.	.	221	146	75
Knee-Joint	.	.	.	.	5	2	3
Leg	.	.	.	.	83	63	20
Ankle	.	.	.	.	137	124	13
					<u>461</u>	<u>342</u>	<u>119</u>
UPPER EXTREMITY.							
Shoulder-Joint	.	.	.	.	34	22	12
Arm	.	.	.	.	56	38	18
Elbow-Joint	.	.	.	.	2	1	1
Forearm	.	.	.	.	51	39	12
Wrist	.	.	.	.	5	5	0
					<u>148</u>	<u>105</u>	<u>43</u>
Total Upper Extremity	.	.	.	.	148	105	43
„ Lower „	.	.	.	.	461	342	119
					<u>609</u>	<u>447</u>	<u>162</u>

TABLE II.—RESULTS in relation to Injuries or Diseases for which the Operation was performed, up to 1870.

STATISTICS OF AMPUTATION—LOWER EXTREMITY AT HIP-JOINT.

		No.	Recovered.	Died
INJURY	{ Primary .	5	1	4
	{ Secondary .	0	0	0
DISEASE	{ Malignant Tumour of Femur	2	2	0
	{ Malignant Tumour of soft parts	1	0	1
	{ Chronic Disease of Neck of Femur .	1	0	1
Total of Hip-Joint		9		

AMPUTATION OF THIGH—INJURY.

PRIMARY	.	.	.	.	20	6	14 ^a
SECONDARY	{ Burns .	.	.	.	3	2	1
	{ Acute Necrosis after fracture	.	.	.	2	0	2
	{ Gangrene (Traumatic)	.	.	.	4	1	3
					29	9	20

DISEASE.

	No.	Recovered.	Died.
Disease of Knee-Joint	79	67	12
Necrosis and Secondary Disease of Knee-Joint	13	8	5
Acute Necrosis of Femur (Idiopathic) . . .	8	1	7
Necrosis of Shaft of Femur	6	4	2
Repeated Hæmorrhage after removal of Necrosed Fibula	1	1	0
Malignant Tumours of Femur	11	5	6
Malignant Tumours of Tibia	3	3	0
Erectile Tumour of Leg	1	0	1
Gangrene in Diffuse True Aneurism . . .	1	0	1
Large Strumous Ulcers of Leg	3	2	1
	126	91	35
Total of Thigh	155	100	55

AMPUTATION AT KNEE-JOINT.

PRIMARY	1	0	1
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LEG.

	No.	Recovered.	Died.	
INJURY . .	{ Primary 28	15	13	} Railway and cart accidents.
	{ Secondary 3	1	2	
Total . .		31	16	15
DISEASE . .	22	21	1	

^a. The causes of death in the 14 fatal cases were—In 7, Shock and Hæmorrhage ; in 2, Gangrene ; in 5, Pyæmia.

		ANKLE-JOINT.		
		No.	Recovered.	Died.
INJURY	{ Primary	4		1
	{ Secondary—Gangrene . .	1		0
	{ Contraction			
	{ from Burn } . .	1		
DISEASE		76	71	5
Total .		82	76	6

UPPER EXTREMITY—AMPUTATION AT SHOULDER-JOINT.

		FOR INJURY.		
PRIMARY . . .	{ Gunshot wound	1	1	0
	{ Railway Injuries	8	4	4
	{ Machine Injuries	6	5	1 <i>b</i>
	{ Waggon-wheel passing over			
	{ Arm	1	1	0
SECONDARY . . . Effects of Burn . .		2	2	0
Total		18	13	5
DISEASE . . .	{ Subclavian Aneurism . . .	1	1	0
	{ Malignant Tumours	4	3	1
Total Injury and Disease		23	17	

		ARM—FOR INJURY.		
PRIMARY . . .	{ Gunshot	2	1	1
	{ Railway	6	2	4
	{ Machine Injuries	4	3	1
	{ Compound Dislocation of			
	{ Elbow and Fracture . . .	1	0	1 <i>c</i>
Total		13	6	7
SECONDARY . .	{ Traumatic Gangrene	3	2	1
	{ Necrosis after Injury of			
	{ Forearm	1	1	0
	{ Effects of Burn	3	2	1
	{ Gunshot wound of Hand . .	1	1	0
	{ Machine Injury of Hand			
	{ and Forearm	1	0	1
		9	6	3
Total for Injury—Primary and Secondary		22	12	10

b. Secondary Hæmorrhage.*c.* A woman of intemperate habits, *ætat.* 70.

ARM—FOR DISEASE.

	No.	Recovered.	Died.
Osteo-Sarcoma of Forearm . . .	1	1	0
Strumous Disease of Elbow and Forearm	8	7	1
Results of Erysipelas . . .	1	1	0
Acute Necrosis of Humerus in a child .	1	0	1
	—	—	—
Total for Disease . . .	11	9	2
	—	—	—
Total Injury and Disease . . .	33	21	12

FOREARM—FOR INJURY.

PRIMARY . . .	{ Machine Injury . . .	21	18	3
	{ Gunshot do. . .	6	5	1
SECONDARY . . .	{ Traumatic Gangrene . . .	1	1	0
	{ For Sloughing of Flaps after Wrist Amputation		1	0
			—	—
Total Injury . . .		29		4

FOR DISEASE.

Erectile Tumour	1	1	0 <i>d</i>
Disease of Carpus	12	9	3
Epithelial Cancer	1	0	1
	—	—	—
	14	10	4
	—	—	—
Total Injury and Disease	43	35	8 *

WRIST.

Primary
Disease

d. In an infant six weeks old, amputated in consequence of hæmorrhage from the tumour.

RESULTS in relation to Injuries or Diseases for which the operation was performed (from 1870 to 1875).

STATISTICS OF AMPUTATION.

I. LOWER EXTREMITY.

1. Amputation at Hip-Joint.

	No.	Recovered.	Died
A. INJURY	0	0	0
B. DISEASE—			
Disease of Hip-Joint	1	1 <i>e</i>	0
Necrosis of Femur	1	1	0
Total at Hip	2	2	0

2. Amputation at Thigh.

A. INJURY—			
<i>α</i> . Primary.—Compound Fracture of Leg	2	1	1 <i>f</i>
<i>β</i> . Secondary.—Compound Fracture of Leg	1	1	0
After-Luxation of the Knee and			
Ligature of Posterior Tibial			
Artery	1	1 <i>g</i>	0
Crush to Knee	1	1	0
B. DISEASE—			
Disease of Knee-Joint	19	15	4 <i>h</i>
" " with Necrosis	3	0	3 <i>i</i>
Carry forward	22	15	7

e. Amputation was performed on 13th April, the joint having been excised on 29th October previous.

f. The amputation was performed for a severe compound comminuted fracture of both bones of the leg, caused by a fall of about thirty feet. In addition to the fracture there was a bruise and abrasion over the sacrum, and after the operation he showed well-marked symptoms of having received injury to the spine. Died a week after the amputation.

g. Vide *Medical Times and Gazette*, November 14, 1874.

h. In one of the fatal cases the patient was a girl aged seven, affected with gelatinous disease of the knee. This improved under treatment, but, as the disease returned again, amputation was found necessary. Previous to the amputation, symptoms of cerebral mischief were present, and the child died about a month afterwards of tubercular meningitis. In another case the patient was also of an extremely strumous diathesis, and was suffering from gelatinous disease of the knee. In this case the extension pulley was used to prevent the retraction of the flaps. In the third, although no cerebral symptoms were present before the amputation, they appeared afterwards: *Post-mortem* examination showed purulent effusion into the ventricles of the brain. In the fourth, comparative dulness was observed over the whole of apex of right lung before operation. Fifteen days after amputation patient had a rigor, after which he gradually sank, and died on the twenty-fourth day.

i. In one case the patient had been suffering for ten years from cario-necrosis of the popliteal part of the femur. Three weeks after admission he had bleeding from the bowels,

	No.	Recovered.	Died.
Brought forward	22	15	7
After Excision of Knee	2	2	0
Necrosis of Femur	1	0	1 <i>j</i>
Cancer of Condyle of Femur	1	0	1 <i>k</i>
Malignant Tumour of Femur	1	1	0
" " Tibia	1	1	0
Elephantiasis	1	1	0
Resection of Stump	1	1	0
Osteo-myelitis after Amputation of Leg	1	0	1 <i>l</i>
	31	21	10
Total at Thigh	36	25	11

3. Amputation at the Knee.

A. INJURY—

Injury from Fall

B. DISEASE—

Constitutional Ulcer of Leg	1	0
Caries of head of Tibia	0	1 <i>m</i>
	1	1
Total at Knee	2	1

with pain in the abdomen. After the removal of some dead bone, bleeding from the wound came on, and after several ineffectual attempts to stop it amputation was performed. Bleeding occurred from the stump two or three days after the operation, and as all attempts to check it proved unsuccessful, ligature of the femoral was performed. He gradually sank, and died the day after ligature, and five days after the amputation. In the second case the patient had suffered for many years from necrosis of the tibia and abscesses. When admitted he had an abscess connected with the necrosed tibia, and his knee-joint had become affected; and at the time of the operation he was in a very unhealthy state. In the third, the patient when a boy had a piece of necrosed bone removed from the calf of his leg. This healed quite well, but three weeks before admission he received a "twist" in a coal-mine, whereupon an abscess formed near the knee, and discharged great quantities of pus. After amputation diarrhoea set in, and a large abscess was formed in the posterior flap. Sweating, cough, and emaciation now appeared, death occurring from exhaustion seven weeks after the operation.

j. The disease was of long standing,—a sinus had been discharging from the thigh for several years. After the amputation erysipelas of the opposite limb set in, and death took place on the eleventh day.

k. Death from pyæmia after repeated hæmorrhages.

l. Patient was of marked strumous diathesis, and had suffered for some time from cario-necrosis of the lower end of the tibia. After amputation of the leg, osteo-myelitis supervened, abscesses formed around and in the knee-joint, and amputation of the thigh was found necessary. At the time of his admission he was phthisical, and after the amputation of the leg he had hæmoptysis. He died of diarrhoea five days after the amputation of the thigh.

m. Patient was a strumous boy of 14 years, who, six years previously, had had a large sequestrum removed from the anterior part of the shaft of the tibia. Death occurred from pyæmia following excessive hæmorrhage.

4. *Amputation at Leg.*

A. INJURY—

	No.	Recovered.	Died.
<i>a.</i> Primary.—Compound Fracture of Leg	2	1	1 <i>n</i>
<i>β.</i> Secondary.—Compound Fracture of Leg	1	0	1 <i>o</i>
Ununited Fracture of Leg	1	1	0 <i>p</i>

B. DISEASE—

Caries of Ankle	2	0
Disease of Stump and resection	2	0
Gelatinous Disease of Ankle	1	0
Necrosis of Tibia	1	0
Gangrene after Typhus	1	0

Total at Leg 11

5. *Amputation at Ankle.*

A. INJURY—

<i>a.</i> Primary.—Laceration of Foot and Ankle	1	1	0
<i>β.</i> Secondary.—Bruise of Foot and Thigh	1	0	1 <i>q</i>
Contraction after Burn	1	1	0

3 2 1

B. DISEASE—

Caries of Ankle-Joint (or Tarsus)	24	21	3 <i>r</i>
-----------------------------------	----	----	------------

Total at Ankle 23 4

n. The whole of the anterior part of the right foot was reduced to pulp ; the bones of the left leg were fractured and comminuted, and a small wound was observed over the site of fracture, but not communicating with it. The patient had received also two scalp wounds, and an abrasion of the face. Erythema, with emphysema of the left thigh, set in, and death occurred five days after the accident.

o. Patient sustained a severe injury from "topcake" of casting falling on his leg, and had lost much blood previous to admission. On examination there was found a compound comminuted fracture of the tibia and fibula. Small pieces of comminuted bone were removed by the opening, and the patient was treated for the cough from which he suffered. An abscess formed above the wound, and amputation was resorted to twelve days after admission. Next day he had a slight shiver, and two days later pyæmia was seen. Death took place seven days after the operation.

p. The fracture had occurred in childhood, and rendered the limb useless.

q. Death from tetanus.

r. In two of these cases partial amputation of the foot had been tried. One of these died from pyæmia. Of the other two deaths one was due to phthisis, and one to exhaustion from profuse discharge.

II. UPPER EXTREMITY.

1. *Amputation at Shoulder-Joint.*

A. INJURY—

	No.	Recovered.	Died.
a. Primary.—Compound Fracture of Arm	1	0	1 s
Arm Amputated by railway train	1	1	0
Arm and Side Crushed in railway accident	1	0	1 t
Extensive Injury to Soft Parts	1	0	1 u
Arm Crushed by railway engine	1	1	0
β. Secondary.—Compound Fracture of Arm	1	0	1 v
For result of Burn and Fungoid Tumour	1	1	0
	7	3	4

B. DISEASE—

Amputation (after Excision) for Caries	1	0	1 w
Total	8	3	5

2. *Amputation at Arm.*

A. INJURY—

a. Primary.—Machine Accident	1	0	1 x
β. Secondary	1	0	1 y
Necrosis of Bones of Forearm and Ulceration of Vessels after Injury	1	1	0
	3	1	2

s. Patient had his arm entangled in machinery, while trying to arrange a belt in a saw-mill, and was brought to the infirmary in a very exhausted condition, suffering from fracture of the humerus, compound comminuted fracture of both bones of the forearm, and with the wrist reduced to pulp. Amputation was performed at once, but the patient died forty hours afterwards. *Post-mortem* examination showed extravasated blood in the left pleura, and fracture of five upper ribs.

t. At the time of the accident the patient was out on pass from the Medical House, where he was under treatment for mitral and aortic disease, with bronchitis. He had also lost much blood prior to admission.

u. Arm crushed between the buffers of two trucks of railway train. Death occurred from secondary hæmorrhage fourteen days after the accident.

v. Patient had sustained compound fracture of the humerus from passage of cart across his arm. Gangrene set in, and the left shoulder-joint became swollen and painful. Amputation was performed two days after the accident. Induration and pain at the left knee then appeared, and patient sank five days after the operation, and the shaft of the humerus broke owing to its diseased state.

w. Axillary wall of chest apparently one large abscess. Excision of the head of the humerus was followed by discharge of immense quantities of pus. Amputation. Death occurred from exhaustion four days after operation.

x. Forearm and arm crushed between rollers of paper machine. Brachial artery exposed at bend of elbow. Twenty-two days after the operation the shoulder became swollen and painful. An opening into it liberated a quantity of pus. Death occurred twenty-seven days after the accident.

y. History of case in Journal very imperfect,—the original injury seems to have been followed by erysipelas.

B. DISEASE—

	No.	Recovered.	Died.
Disease of Elbow	1	1	0
Medullary Sarcoma of Hand	1	0	1 <i>z</i>
Caries of Forearm and Wrist	1	1	0
	<hr/>	<hr/>	<hr/>
	3	2	1
	<hr/>	<hr/>	<hr/>
Total at Arm	6	3	3

3. Amputation at Elbow-Joint.

A. INJURY—

Crush to Forearm	1	1	0
Compound Fracture of Forearm	1	0	1 <i>a</i>
	<hr/>	<hr/>	<hr/>
	2	1	1

B. DISEASE .

	0	0	0
	<hr/>	<hr/>	<hr/>
Total at Elbow	2	1	1

4. Amputation at Forearm.

A. INJURY—

Primary.—Crush by machine			1 <i>b</i>
Do. do.			0

B. DISEASE—

Ulcer on Hand	1	1	0
After poisoned Wound and Inflammation of Fibrous Textures of Hand and Fore- arm	1	0	1 <i>c</i>
Epithelioma of Wrist	1	0	1 <i>d</i>

Carry forward 1

z. Previous to his admission the thumb had been amputated for the same disease, but it never healed properly, and the disease returned. After the amputation the stump bled profusely several times, but no bleeding point could be seen on taking it down. Though no further hæmorrhage occurred there was a continuous discharge of red-coloured serum, and the patient died exhausted two days after the operation.

a. The accident happened from a fall in the shaft of a coal-mine. On admission there was a compound fracture of the ulna, with simple fracture of the radius, and great laceration of the flexor muscles. Death occurred from pyæmia.

b. The soft parts had been subjected to a considerable amount of crushing by being caught in the teeth of a hay-cutting machine. The patient was of intemperate habits, and he had a mitral regurgitant murmur. He died of pneumonia a fortnight after the operation.

c. Inflammation had spread up the arm and forearm, implicating the fibrous textures of these parts. Death took place one month after the amputation, of pleurisy and pneumonia.

d. Patient was sixty-seven years of age. Prior to his admission the epithelioma had been treated with caustics, and when he came to the hospital the parts were fetid and sloughy. His general health was in a bad state, his pulse weak, etc., and after the

	No.	Recovered.	Died.
Brought forward	3	1	2
Resection of Bone in Stump	1	1 <i>e</i>	0
	<hr/> 4	<hr/> 2	<hr/> 2
Total at Forearm	<hr/> 6	<hr/> 3	<hr/> 3

5. *Amputation at Wrist.*

A. INJURY—

Crushed Hand 1 1 0

B. DISEASE 0 0 0

Total at Wrist 1 1 0

TABLE III.—RESULTS in relation to INJURIES or DISEASES for which the Operation was performed. (From 1875 to March 1882.)

STATISTICS OF AMPUTATION.

I. LOWER EXTREMITY.

1. *Amputation at Hip-Joint.*

A. INJURY	0		
B. DISEASE—			
Disease of Hip-Joint	2	1	1
Necrosis of Femur	1	1	0
Malignant Tumour of Thigh	1	0	1
	<hr/> 4	<hr/> 2	<hr/> 2
Total at Hip			

2. *Amputation at Thigh.*

A. INJURY—			
α. Primary.—Railway Injury	3	1	2
Omnibus „	1	0	1
β. Secondary.—Compound Fracture of Leg	2	0	2 <i>f</i>
After Excision for repeated			
Bleeding	1	1	0
Compound Fracture of Thigh	1	1	0

removal of the limb the stump was attacked by phlegmonous erysipelas, which proved fatal in about a fortnight.

e. The original amputation was for disease of the wrist, but the cicatrix of the flaps had never been complete, and on passing in a probe bare bone could be felt. New flaps were cut, and the bare bone removed.

Notes to Table III. (From 1875 to March 1882.)

f. One of these cases was for compound fracture of leg. Extensive necrosis of tibia

B. DISEASE—	No.	Recovered.	Died
Gelatinous Degeneration of Knee .	14	13	1
Extensive Strumous Disease .	4	3	1 <i>g</i>
Malignant Tumour of Leg and Foot .	1	1	0
Disease of Tarsus and Ankylosis of Knee	1	1	0
Necrosis of Femur .	2	2	0
Gummatous Tumour of Leg .	1	0	1 <i>h</i>
	—	—	—
	23	20	3
	—	—	—
Total at Thigh	31	23	8

3. Amputation at Knee-Joint.

A. INJURY—			
α. Primary	0	0	0
β. Secondary.—Osteo-myclitis after Primary at Ankle	1	0	1 <i>i</i>
	—	—	—
Total at Knee-Joint	1	0	1

4. Amputation at Leg.

A. INJURY—	
α. Primary.—Railway Injuries	
Do., Double Operation	
β. Secondary.—Compound Comminuted Fracture	

B. DISEASE <i>k</i> —			
Cario-Necrosis	12	11	1 <i>l</i>
Painful Stump	2	2	0
Cancerous Disease of Leg	1	1	0
	—	—	—
	15	14	1
	—	—	—
Total at Leg	19	17	2

took place with sloughing of the soft parts, so that a fortnight after admission it was found necessary to amputate the thigh through its lower third. The patient died two days after operation. Six were for disease of knee-joint. In three of these the spray had to be stopped, as the wounds had become septic, the other three remaining aseptic.

g. This case, a child *set* five, died three days after the operation from a serious hæmorrhage which took place into the gauze dressing. Of the remaining two one was amputation for disease of tarsus and ankylosis of knee. This case continued aseptic throughout, and was perfectly healed on the twenty-third day.

h. This was one of amputation for a gummatous tumour of leg. Six days after the operation spray was discontinued on account of the profuse discharge. Patient ultimately died of bronchitis, after the stump had healed.

i. The amputation at the knee was secondary for osteo-myclitis, following amputation at ankle for injury. In three days after operation the wound was putrid, and spray stopped. Patient died on the ninth day.

k. The amputations through the leg were for disease of tarsus and lower part of bones of leg. Three of the cases were aseptic throughout. In two the spray was stopped on nineteenth and eighteenth days respectively, the wounds being quite superficial.

l. In this case the patient died on the twenty-ninth day from phthisis, the operation

5. Amputation at Ankle.

A. INJURY—	No.	Recovered.	Died.
α. Primary.—Railway Injury .	1	1	0
β. Secondary.—Railway „ .	1	0	1
	—	—	—
	2	1	1
B. DISEASE—			
Cario-Necrosis .	26	24	2
	—	—	—
Total at Ankle	28	25	3 .

II. UPPER EXTREMITY.

1. Amputation at Shoulder-Joint.

A. INJURY—			
α. Primary	0	0	0
β. Secondary.—Compound Comminuted Fracture at Shoulder	1	1	0
	—	—	—
B. DISEASE—			
Strumous Disease of Humerus and Acromion	1	1	0
Malignant Disease of Humerus	1	0	1

Total at Shoulder

2. Amputation at Arm.

A. INJURY—			
Primary.—Machine Injury	1	0	1
Compound Comminuted Fracture	2	2	0 m
	—	—	—
Carry forward	3		1

having been performed merely to relieve him of his suffering. Of the other three one became septic, and the spray had to be stopped. In another it had to be discontinued on account of carbolic acid poisoning, while the third is not fully reported.

The amputation at ankle was for disease of the tarsus. On the sixth day after the operation the stump became erythematous, and the spray treatment had to be discontinued. Patient ultimately made a good recovery.

Summary.—Of the seventeen amputations of the lower extremity six became septic, and spray had to be discontinued. Nine remained aseptic. The spray was stopped in another case owing to erythema, while the seventeenth case is not fully reported.

Of the cases that remained aseptic three died, while two died of those that became septic.

m. One of these primary amputations was for a compound dislocation of elbow, with compound fracture of bones of forearm. The circular amputation was performed on the 3d December. The spray was turned on after the operation, and the stump dressed with

	No.	Recovered.	Died.
Brought forward . . .	3	2	1
β. Secondary.—Extensive Burn	2	2	0
Gun Accident . . .	1	0	1 n
Hæmorrhage after Excision	2	2	0
„ Amputation	1	1	0
Comminuted Fracture of Hand and Wrist . . .			
Diffuse Cellulitis after In- jury to Forearm . . .			
	11		
	—		

B. DISEASE—

Strumous Disease of Elbow	3		0 o
Malignant Tumour . . .	1		1
Suppuration of Forearm	2		0
	—		—
	6		1
	—		—
Total at Arm	17	14	3

gauze dressing. On 7th December spray discontinued, as the wound appeared putrid, and boracic dressing used. The day after the operation the temperature mounted to 101°. Next day it fell, and afterwards varied from 98.4° to 100°.

Of the secondary amputations of arm, two were for injuries to the hand and forearm, followed by inflammation of the soft parts. In one case the spray was stopped five days after the operation, the wound having become septic; in the other the spray was discontinued twelve days after the operation to prevent the breaking up of the cicatrix, the drainage opening continuing to discharge.

Of the three other cases one was a Teale's amputation for inflammation of the fibrous textures of the hand and forearm. The wound remained aseptic until the spray was stopped, and wound superficial. The other was amputation for secondary hæmorrhage following excision of elbow for gelatinous disease. The spray was continued until the wound was quite healed, and dry lint used for dressing twenty-eight days after operation.

n. The third and fatal case was amputation from an injury to the hand by the bursting of a toy gun, followed by inflammation of soft parts. The patient's temperature and pulse still remained high, averaging about 102°, and finally he gradually sank, and died with symptoms of pyæmia fourteen days after the operation, which was performed under antiseptic precautions.

o. One of these cases of amputation for disease is one in which excision of elbow had been performed two years previously for strumous disease. Strumous sinuses and ulcerations continuing round the elbow necessitated amputation through arm. In fourteen days the spray was discontinued, the wound having completely healed, leaving an admirable stump.

The primary at forearm was for a crushed and lacerated hand. Teale's amputation was performed under spray. Wound healed by first intention, except at drainage openings. The spray was stopped twenty-eight days after operation, when the drainage tracks had closed.

Summary.—Of the eight amputations of the upper extremity two had the spray stopped within five days after the operation from the wounds becoming septic. Four continued the spray until the wounds were superficial, and dry dressings substituted for the gauze. One had spray stopped to prevent the breaking up of the cicatrix from the moist dressing in connection with it. One died fourteen days after the operation with symptoms of pyæmia.

3. *Amputation at Forearm.*

A. INJURY—	No.	Recovered.	Die
α. Primary.—Railway Injury	1	0	1
Laceration of Hand	2	2	0
β. Secondary	0	0	0
	—	—	—
	3	2	1
	—	—	—
B. DISEASE	0	0	0
	—	—	—
Total at Forearm	3	2	1

4. *Amputation at Wrist.*

IN regard to primary and secondary amputation, as I have said, so much has been done by comparative statistics, that I shall merely advert briefly to some circumstances which, in my opinion, cause the great mortality attending primary amputation.

The general conditions which most evidently determine the unfavourable issue are—shock, loss of blood, gangrene of the stump, or pyæmia; and, from my own experience, I would add the co-existence of other lesions, not in themselves very dangerous, and great comminution, especially longitudinally-fissured fracture of the bone or bones through which the amputation is performed; and, lastly, certain moral causes reacting on and depressing the physical powers.

Shock, or that peculiar effect of injury on the vital powers, mental and physical, with tendency to collapse, though difficult to define, is only too obvious in most cases of injury requiring amputation, to be overlooked as a condition unfavourable to the result, whether by depressing the vital powers so that reaction does not take place, or from the effects of over-reaction in a patient whose vital powers are for the time diminished. It may be accompanied and aggravated by hæmorrhage; but even without any loss of blood, the effects induced by the shock on the nervous system are always marked by extreme depression and collapse, and that even when the patient's feeling of pain seems to be benumbed rather than exalted. Very little irritation, or pain, or exposure to cold, superadded to this state, I believe to be sources of great additional danger, both immediate and secondary; and to these causes I attribute much of the fatality which attends primary amputation in civil hospital practice, where most of the cases are brought from some distance—often from a long distance—by cart or railway. The state of a patient with a torn and broken limb, carried even with the greatest care, is aggravated by the slightest movement, and fresh shock superadded. I have on two occasions accompanied patients under these circumstances from short distances in the country, and though an opiate had been given, and the fractures were arranged and supported, the limbs slung, the carriages very easy and the roads good, yet the slightest

jolt or sudden motion of the horses caused exacerbations of suffering and faintness, requiring the administration of stimulants. In one of the two cases alluded to the soft parts were principally injured, the fibula alone being fractured. If such were the effects of removal under every advantage, I could not help asking myself what must be the condition of most patients brought to hospital with severe injuries? The loss of blood resulting from the injury, and any subsequent hæmorrhage either during the transport of the patient or in the amputation, is so evident a cause of danger, so frequently associated with and aggravating the shock, that I need not dwell on it further than to point out the necessity of prompt attention to this so soon as the patient comes under your care. You should not only be satisfied that there is no hæmorrhage externally, for I have frequently found bleeding taking place into and infiltrating the limb; and the patient may sink from this cause. Indeed, I have not unfrequently been obliged to amputate when the pulse was very weak, because, from this kind of hæmorrhage, it was obvious that delay would only have led to greater debility from loss of blood. Under other circumstances, it is always proper to have a fair amount of reaction before operating. Having said thus much of the effects of shock and loss of blood, let us look now how some primary amputation cases are situated as to these dangers.

Of the five cases of primary amputation at the hip-joint, one was brought a distance of more than fifty miles, partly by cart, over bad roads in a hill district, and partly by railway, and was admitted into hospital late in the evening, the injury having been received about half-past six in the morning. The injury occurred from the explosion of a large iron flask containing gunpowder, which he had in the pocket of his trousers. The whole of the thigh, abdomen, and lower part of his thorax were scorched; all the soft parts on the front and inner part of the thigh, with the exception of the femoral artery, torn through; and the branches of the profunda were bleeding into the textures of the limb, so that amputation had to be performed at once. In another of the fatal cases the patient had one limb shattered and torn off immediately below the knee, and a severe compound fracture of the other leg. In this case there had been great loss of blood at first from the torn arteries of the severed limb, but it had been arrested by tying a handkerchief round the limb and twisting it tight by means of a stick used as a rack-pin. In the third case, the patient was brought from a distance, and had evidently suffered both from severe shock and loss of blood prior to the operation. Neither of the last two cases ever fairly recovered from the effects of shock. In both of them the injury was caused by a train of railway trucks passing over the limbs, and the patients were otherwise bruised, though there were no internal injuries. In another case, a little girl, six years of age, was run over by a heavily-laden cart. The wheel passed over her right knee and left thigh, producing a lacerated wound of the former and a compound comminuted fracture of the latter, with extensive destruction of the soft texture in front to within three inches of Poupart's ligament. The accident happened in town, and the child was admitted into hospital half-an-hour after the accident. There had been profuse bleeding at first, but that had been

arrested before admission. I amputated some hours afterwards, when reaction was established. There was little sound texture to form flaps, and some sloughing of the margins of the flaps took place. For a time, however, the wound looked so healthy that I was in hopes of her recovery. But ultimately she became very much exhausted, and died about eighteen days after the operation. In this case there were some peculiar conditions which probably affected the result unfavourably. Besides the injury of the limb amputated, there was a laceration of the textures over the right knee, a second source of irritation. But there was also an unfavourable state of constitution, for the injured knee had been the seat of disease, and she had previously suffered from necrosis. Both these conditions had been successfully treated in my wards about a year previously; but, of course, the state of the parts when subjected to a new irritation must have reacted unfavourably on the health, tending to produce exhaustion after the amputation.

The fifth, which was the first and only successful case of primary amputation at the hip-joint, so far as I know, which had then occurred in Scotland, was performed under different circumstances. I was sent for, and performed the operation in the country, so that the lad had only been removed from the railway station, where the accident happened, to his own home, a very short distance. He was carefully carried on a litter, the injured limb having been first supported by a splint. In all other respects the conditions were certainly not more favourable than in hospital. The injury was a severe one, attended by some loss of blood, though that was arrested by the medical man who first saw him. Eight or nine hours had elapsed from the time of the injury till I reached him, and he was then much depressed. The operation was performed under certainly less advantageous circumstances than in hospital. For although the professional assistance I had was excellent, still I had to depend upon non-professional aid for the performance of some important duties; and when I add that the operation was performed in a small room, with no other light but that afforded by two small tallow candles, and a wax taper which I had brought with me, the circumstances will not compare favourably with the advantages of a hospital operation. Yet the compression of the vessels was so efficient, that the amount of blood lost, when collected and measured, did not quite half fill a small teacup. In regard to the after-treatment, the patient was no doubt in the country, and it may be said that pure air is everything, and certainly it is most important; but the house was small, the room in which he lay so small that one person only could stand between his bed and the wall, and the only window in it was composed of a single small pane of glass. The street of the village was narrow, and with surface drainage. Yet this patient made a good recovery. Was it due to the pure country air, or to his not having been removed to a long distance after the injury, and so having been saved from increased shock? I cannot help thinking that it was chiefly due to the latter circumstance. I have come to that conclusion from what I have observed in cases of other primary amputations, such as those through the thigh and leg; for, whilst the amputation of the hip is undoubtedly a very serious operation, similar

circumstances to those I have mentioned seem to determine the favourable or unfavourable result in other amputations. In the fatal cases of primary amputation of the thigh and leg, almost all had been brought from a distance, or after long exposure, and having lost blood; and in the majority other injuries were present. In the successful cases, on the other hand, the operation was either performed in the country, where the accident took place, or when the nature of the injuries was peculiar, consisting either of laceration and destruction of the soft textures, of ploughing up of the texture of the bone by toothed machinery, or compound impacted fracture, or else means had been taken to arrest all bleeding and adjust the limb previous to removal of the patient to the hospital. The patients in the successful cases had thus either been saved all shock, except that of the original injury, or any secondary shock in those who were removed to hospital had been considerably diminished either by the character of the lesion or the means taken to prevent motion of the injured parts and loss of blood. I think that the circumstances alluded to are obviously in accordance with what we might expect when we consider the effects of such injuries as those entailing a necessity for amputation. By the first shock of the injury the patient is as it were stunned, the sensorial functions are disturbed, and his general feelings benumbed, so that pain is seldom complained of; but as he revives and becomes excited, his nervous sensibility becomes exalted, disturbance in this condition causes excessive pain, gives rise to shivering, and a feeling of sinking, and produces a marked effect on the pulse. This I have observed in the cases in which I accompanied the patients to town, and I therefore have come to regard removal of cases requiring amputation as of very doubtful propriety. But whilst I draw your special attention to this, there are various other conditions which are obviously causes of danger in cases which are brought even from a short distance. The patients may be exhausted by exposure, loss of blood, and prolonged suffering, as happened in some instances where the accident occurred during the night, and the sufferers remained undiscovered for many hours, exposed to inclement wintry weather.

Gangrene of the stump is not, according to my experience, frequent in cases of primary amputation. I have met with only three cases in my own practice. Two of these occurred after amputation at the upper third of the thigh, for severe railway injury, and in both there had been great loss of blood previous to the patient having been brought into the hospital. In one the gangrene attacked the surface of the stump on the second day after the operation, and proved rapidly fatal. In the other patient the gangrene was partial, arising apparently in some deep muscles which had suffered injury above the point of amputation. A considerable part of the wound had healed on one side of the stump when foetid discharge began to take place. Arterial hæmorrhage occurred, and on opening up the stump to arrest the bleeding, the sloughy state of the deep part of the wound was noticed: the sloughing had opened into the femoral artery about an inch and a half above the point where it had been tied in the amputation. The vessel was secured higher up, but the deep-seated sloughing continued, and

the patient gradually sank. In the former of these cases the patient had suffered both from excessive shock and great loss of blood, and when brought into hospital he was so collapsed that it was doubtful whether he could bear the operation, but as bleeding was going on into the tissues, the operation seemed his only chance. The main artery was compressed and stimulants given; but during his removal from the receiving-room to the operating theatre his respiration and pulse became so feeble that I had again to give stimulants, and wait for some reaction before operating. We can be at no loss to understand how, in a patient so debilitated, the general and local vital powers should be so impaired as to lead to gangrene, instead of healthy reparative action. The second case was more insidious in its course, as, beyond the foetid discharge from one part of the stump, there were neither local nor general symptoms indicative of gangrene. The secondary hæmorrhage caused by the sloughing, by debilitating the patient, doubtless made the after-progress of the gangrene more rapid. The third case of gangrene of the stump occurred after an amputation of the forearm, performed on account of gunshot wound of the hand. The patient, a man of excessively intemperate habits, was attacked with delirium tremens the day after the operation. Erysipelas of the stump, forearm, and arm supervened, and assumed the gangrenous character, and proved fatal. In this case the previous habits and broken-down constitution of the patient, rather than the amputation or the nature of the injury, must be looked to as explaining the tendency to gangrene.

The most general cause of death in cases of primary amputation, when the patients survive the more immediate dangers of shock and loss of blood, is the condition termed pyæmia.

Pyæmia is often spoken of as if it were specially a hospital disease, depending on the effects of hospital air. From the greater number and severity of the surgical cases occurring in hospital, we can scarcely wonder that pyæmia should be more frequently met with there than in private practice; but it is by no means confined to hospitals; and from considerable experience and observation of this diseased state, I believe that its occurrence is much more determined by the state of the patient prior to an operation, or to depressing causes occurring afterwards, than is generally admitted; and that, in cases of primary amputation, besides the more obvious depressing causes, certain forms of lesion specially conduce to its occurrence. Thus, I have noticed that the risk of pyæmia is always greatest in cases where the amputation has been performed through the continuity of the bone or bones which had been fractured. This is specially noticeable in primary amputation of the leg and upper arm, for railway and gunshot injuries. In these cases the fatality attending the operation is very great, whilst in cases where, from the severity and extent of the injury, we are forced to amputate beyond the injured bone at the shoulder-joint, or immediately above the knee, the success is greater. In cases of amputation at the shoulder, I am so satisfied of the diminished risk to the patient, that I feel relieved when the nature of the injury leaves no

room for amputation through the injured humerus. In the fatal cases of primary amputation at the shoulder, the deaths were due to the effects of other injuries, and the great loss of blood in one case prior to the operation; but in my own practice I never saw a patient die from pyæmia after primary amputation at the shoulder.

As a general rule, the less of the limb removed the less is the risk, but there are exceptions to all rules; and in cases where a bone is much shattered, the risks of acute necrosis and osteo-myelitis attacking the bone of the stump, and so inducing pyæmia, are so great as to warrant in many cases amputation at or above the neighbouring joint. The co-existence of other injuries, not in themselves dangerous, such as simple fracture, or even contusions of other parts of the body, always exercise an unfavourable influence in cases of primary amputation; and, of course, when these injuries are more severe, the risk is greatly increased. In most cases of pyæmia the bone of the stump is found necrosed, and the modulla is often seen to project like a fungoid mass. In such cases it is usually assumed that this condition is the cause of the blood-poisoning. No doubt it may be said that it is quite as likely that the state of the bone is the effect rather than the cause, for all the soft parts show diseased action as well as the bone; and, besides, we occasionally see even acute necrosis of the bone of a stump without pyæmia supervening. Still the possibility of the disease of the bone being the cause is just another reason for amputating beyond the continuity of a bone which has been severely comminuted and fissured longitudinally.

The moral causes which may influence the result unfavourably are more difficult to trace than even the physical. In all cases of severe injury, however, and especially in cases involving mutilation, the mental state, leading to depression, cannot be overlooked. The moral influences of the different circumstances in which, in such cases, the civilian and the soldier are respectively placed, have been stated as amongst the causes predisposing to the less favourable results of primary amputation in civil as compared with military practice.

"A tradesman," says the late Sir G. Ballingall, "who has, perhaps, an indifferent constitution, and a wife and family dependent upon his exertions, is admitted with an injury requiring amputation, which may be the result of an accident, originating in intoxication, ignorance, or folly, and by which he finds himself suddenly reduced to misery and dependence; while the soldier, again, with a constitution originally sound, and accustomed to contemplate such an accident, loses his limb in a good cause, under circumstances creditable to himself, and duly appreciated by his country, from which he is certain of a pension for life."

Now, these appear very satisfactory and obvious reasons why mental depression and anxiety might be expected to be more frequent in the one case than in the other. But, whilst I consider these moral states as most important, I believe it will be found difficult to estimate correctly their influence, except in regard to individuals. For so much depends upon the natural mental constitution, the education, habits, and age of each, that when we come to examine the question closely

it will be found almost impossible to draw any general deductions in regard to it.

The class most liable to such injuries is not in general remarkable for habits of thoughtful calculation with regard to future possibilities, consequently, such opinions as that I have quoted refer rather to what we might expect to be the state of feeling, than what we actually often find it to be. Were patients generally much influenced by the consideration of all the evils which the loss of a limb might entail upon their future prospects, we would expect to see this feeling and its unfavourable effects most generally in amputations of the upper extremity, for surely no other mutilation involves so much prospect of misery to a labouring man or mechanic. Again, when we find a man, as I have seen, suffering from the loss of a limb, his wife struck down with fever, both lying helpless in a miserable room, themselves and their children dependent on the care of strangers, we would expect this depressing influence to exert its utmost power. Yet the man in that condition seemed but little affected, and his case went on favourably to a perfect cure.

In two cases in which the bad effects of mental depression were most obvious, the circumstances were peculiar. In one, the man had in former years suffered the loss of an arm, and had felt painfully all the difficulties and privations which that loss entailed, and when advanced in life he lost the leg of the same side. Thus, he could not but feel to what a perfectly helpless condition such an unusual form of mutilation must reduce him, by depriving him of any means of supporting himself and his family. In the other case, the patient's feelings were painfully excited by the conduct of a young woman, to whom he was on the eve of being married, and who, immediately on hearing that he had suffered amputation, showed the depth of her affection by removing the portion of the furniture she had provided for their intended home. Previously to hearing this, he had been in good spirits, and—except that the pulse kept somewhat high—appeared to be going on favourably; this intelligence, however, completely depressed him, and seemed to predispose to the unfavourable result.

In such cases as these last, mental depression and despondency can hardly be overlooked as having an important influence on the results. Still, I repeat, we can draw no exact general deductions where so much depends on the mental constitution and temperament of the individual.

There is, however, one mental state which should always be recognised, and which should influence our practice, not only in cases of amputation but in all operations—I mean the effect produced upon a patient by witnessing, or hearing of the death, or of any unfavourable condition happening to another who has undergone a similar operation. This is of course most likely to occur in hospital; and in my own practice I make it a rule to avoid placing two patients about to undergo the same operation in one ward, more especially if the prognosis in either case be unfavourable; and I feel satisfied, from observation, that what are termed in some hospitals "Operation Wards," are very objectionable both on this and other grounds, and that operation patients

get on better when scattered throughout the different wards, amongst the less serious cases.

In regard to the question of secondary amputations for traumatic gangrene and those for burns, I have already discussed these subjects, under their appropriate heads, in the earlier part of the Lectures, and therefore need not speak of them here.

I now turn to the results of the amputations performed for disease, with the view of considering what they suggest. I have already said that an operation in itself may be comparatively free from danger, and yet the condition of the patient, or the circumstances under which it is performed, may lead to its performance being attended with great mortality. Perhaps no better example of this could be found than in comparing the results of amputation of the leg for disease with those for injury. Out of 22 cases of amputation of the leg for disease, 21 recovered and 1 died; whilst out of 31 performed for injury, either primarily or secondarily, only 16 recovered and 15 died. But to pass from this, let us now examine into the results of amputations performed for different forms of disease.

One of the most frequent amputations is that at the lower part of the thigh for disease of the knee-joint. The absolute results of my practice in this operation up to 1870 give 79 cases, of which 67 recovered and 12 died, or an average of 1 death in $6\frac{1}{2}$ cases—not a very large mortality for an operation of such magnitude, and so frequently performed as a last resort. There is, however, one thing which I regret I have not sufficiently attended to in connection with this class of cases—namely, to distinguish the cases of gelatinous degeneration from those of articular caries and ulceration of the cartilage. I have a very strong impression that the result of operations, whether excisions or amputations for gelatinous degeneration, will be found much less successful than in other forms of articular disease; and of late, since I have been careful in noting the distinction, my statistics seem to justify the impression. Thus, out of 10 cases of amputation of the thigh for disease of the knee performed by me between February 1867 and 1st May 1869, 5 were cases of articular caries and ulceration of the cartilage, and 5 were cases of gelatinous or pulpy degeneration. Of the former all recovered; of the latter 2 died. I have already pointed out, in speaking of articular disease and of excision of joints, the constitutional complications to which I attribute the fatal results in the gelatinous form of disease.

When we compare the results of amputations for disease of the knee with the results of those performed in cases where the affection of the joint had either supervened upon necrosis of the femur, or in which the patient had previously suffered from necrosis, and where the sequestrum had been removed and a cure obtained, and the joint affection had appeared subsequently, the difference in the mortality is very startling. Of 13 cases of the class referred to, only 8 recovered and 5 died. It seems to me that this mortality is not merely accidental in a limited number of cases, but may be traced to certain constitutional conditions. You may recollect that amongst the fatal cases of excision of the knee-joint 2 were of this kind, and I believe that the unfavour-

able result in such cases is due to the unhealthy state of constitution in which idiopathic necrosis occurs, aggravated by the debilitating influences present during the prolonged process of the disease, the repeated formation of deep-seated abscesses, and the discharge prior to, and even after, the sequestra have been thrown off or removed. In such circumstances, when disease of the joint supervenes either immediately in connection with the necrosis, or manifests itself as a distinct disease some time after the necrosis has been cured, it seems to me we have to deal with a state of constitution very specially predisposed to pyæmia or other form of blood-poisoning. In the rarer cases, where amputation had to be performed for chronic necrosis of the shaft of the femur, the same conditions seem to have led to similar results. Of 6 such amputations, 4 recovered and 2 died.

As regards amputation in acute necrosis of the femur and humerus, whether the diseased action arise idiopathically or from injury, the results are so disastrous that for many years I have refrained from operating, as I believe the patient has a better chance for life by trusting to nature and careful treatment than by having the diseased limb removed. I know that it is very trying to witness the sufferings of young patients when labouring under the irritative fever accompanying acute necrosis, when it seems as if it were impossible for the constitution to bear up against the exhausting process, and when removal of the affected mass by amputation seems so ready and simple a resource. Doubtless the condition of the patient is very dangerous; but I repeat, from experience and observation of a large number of such cases, that the patient has a better chance without the operation; for we must remember what we are very apt to forget, when looking only at one view of the case, the unfavourable conditions which are likely to supervene after an operation performed in such a state, and when there is such a risk of blood-poisoning. After a time, when the irritative fever has passed into hectic, and the discharges become more distinctly purulent, and when neighbouring joints are affected, amputation may be resorted to with better prospect of success; but in most cases the surgeon will find himself rewarded for his anxiety and forbearance by seeing his patient recover without mutilation.¹

The amputations performed for malignant tumours are amongst those that swell the mortality. But it may be noticed that the favourable or unfavourable results seem to be dependent on certain conditions as to the situation of the tumour, whether it is developed in the bone and confined to that structure, or has commenced in or involved the soft parts of the limb, and also by the situation at which amputation is performed. Although in all cases of malignant disease, the state of the blood and peculiar cachexia which accompany such disease, have a marked influence in predisposing to pyæmia, thereby affecting the immediate result as to recovery from the operation, the risks seem most marked in cases where the tumour has originally been developed in the soft parts, or in those where the soft parts have become involved secondarily. Of 11 amputations through the femur for malignant tumour, only 5 recovered. All of the successful cases

¹ See Lecture LVI., page 450, Vol. I.

were for tumours of the bone, and in 4 of them the growths were confined to the condyloid portion of the femur, whilst the amputation was performed at the junction of the middle and upper third of that bone. In the fifth case the tumour involved the lower part of the femur above the condyle, and the operation was performed through the trochanters. In 2 of the 6 fatal cases the condyles were originally affected, but in one of them the patient had refused to submit to the operation till the tumour had involved the shaft and soft parts. The other 4 were tumours of the shaft at its lower part. In these cases, except one where the tumour seemed limited to the condyle, amputation through the trochanters was performed. In 2 cases death resulted from a form of secondary hæmorrhage, or rather a continuous oozing of a sanguineous discharge from the general surface of the stump; the others died with symptoms of pyæmia. Now, if we contrast these results with those of cases of a similar character where the amputation was performed beyond the bone affected, I think it will appear that not only do we give the patient a better chance of subsequent immunity from return of the disease, but that we diminish the immediate risk to life by performing what at first sight may appear a more serious operation: Thus—of 4 cases of amputation at the shoulder-joint for malignant tumour of the arm, 3 recovered and 1 died; of 3 amputations at the lower third of the thigh for malignant tumour of the tibia, all recovered; and of 3 cases of amputation at the hip-joint, 2 recovered and 1 died. The fatal case of amputation at the shoulder was that of a boy whose friends had declined to permit amputation two years previously, and who as strenuously urged its performance when the tumour had involved the soft parts, and when repeated hæmorrhage had so exhausted him that I performed the operation only under protest. In regard to the hip-joint, the two successful cases were examples of malignant tumour developed in the femur, and they both made excellent recoveries, although they were much exhausted at the time of the operation. The unsuccessful case was one of cancerous tumour of the soft parts. The patient had declined interference eighteen months previously, and the tumour had increased greatly, with marked cachexia, at the time of the operation.

If, therefore, we exclude these two cases, and confine our observation to malignant tumours limited to the bone, all the cases of that kind in which amputation was performed beyond the affected bone recovered, whilst in those where amputation was performed through the continuity of the affected bone, 6 out of 11 died. Amputation at the hip I believe is really attended with as little if not less risk in its performance than even amputation through the trochanters; and, whilst it affords the best chance for complete removal of the disease, it is also attended in most cases with a better chance of recovery from the operation. At the same time, when the tumour is limited to the condyle of the femur, I think that in the early stage amputation above the middle of the thigh is sufficiently safe, as in none of the four successful cases alluded to has the disease returned, though several years have passed since the operations were performed.

I have only to remark in regard to the statistics of amputations from 1870 to the present time, that, so far as a smaller number of cases enables me to generalise, these statistics strongly corroborate the inferences drawn in regard to the results of my former series as to amputations for certain forms of disease, more especially in cases of amputation for malignant disease and cases complicated with necrosis.

It will be noticed that in these latter tables there is a larger mortality in amputations of the upper extremity than in the former; but a careful reference to the nature of the disease or injury in the fatal cases, taken in connection with what has been already said in reference to the causes of death, will, I think, serve to explain the increased mortality, and also to show how the results of statistics may fluctuate independent of any change in treatment.¹

It must also be kept in mind how much the average is affected, in a comparatively small number of cases, by two or three fatal results. I am still of opinion that amputation for articular caries, or acute ulceration of cartilage, would, as I have indicated, afford more favourable results than in cases of synovial degeneration. I found, however, in noting the two diseased states with a view to obtain statistical data, that it was practically impossible to obtain reliable statistics, owing to the disorganised state of the joints and the imperfect history of a large number of cases.

Amongst the miscellaneous cases of amputation, whilst some of them possess features of individual interest, they suggest but little in regard to general principles. I would merely notice the case of amputation for gangrene arising from diffuse popliteal aneurism, as one of those which, I think, unfairly swell the mortality of amputation statistics. So far as regarded the amputation no case could have progressed more favourably; the stump had nearly healed, and the patient was sitting up in bed when he died in an instant from rupture of an aneurism of the aorta into the pericardium, a condition totally unconnected with the amputation.

These general remarks on amputation have extended to greater length than I intended; but, before concluding, I would, to prevent misapprehension, recapitulate in the two following statements some points which I wish you to keep in mind.

1st, In all ordinary cases the general rule holds good, that the smaller the amount of the body removed the less will be the risk to life. But in cases of primary amputation, where the bones are much comminuted or longitudinally fissured, I believe that amputation beyond the injured bone really diminishes the risk of pyæmia; and that, in cases of malignant tumours of the shaft of a bone, amputation beyond the diseased bone is distinctly indicated, as it not only affords the greatest chance of immunity from the disease recurring, but actually diminishes the immediate risks.

2d, That whilst, as a general method, I prefer a long and short

¹ As a further example of this fluctuation in results, I may state that during three successive years, 1860, '61, and '62, out of 63 amputations for disease I only lost three patients. See Tables on page 746.

flap, with a moderate amount of muscle, to form a covering for the bone, the muscular substance saved should never be great, as that adds to the risks of suppuration and pyæmia; and the muscle should merely be preserved at that part of the flap corresponding to the end of the bone. But in all cases of amputation for injury or malignant disease, I consider that two equal flaps of smaller dimensions, or the modified circular method, are attended with less risk of retaining diseased structure, or of being followed by sloughing or pyæmia, and that in such cases little or no muscular structure should be retained. The form of the stump must yield to the more important considerations of the complete removal of disease, and diminution of the risk to life.

LECTURE LXXVII.

SPECIAL AMPUTATIONS—The Upper Extremity—Amputation of the Distal Phalanx of Finger: of the whole Finger; of Fingers and their Metacarpal Bones; of the Thumb—Partial Amputation of the Hand—Amputation at the Wrist-Joint—Lines of Incision and form of Flaps—Amputation of the Forearm—By Double Flap—Teale's Method by Transfixion.

THE general subject of amputation has now been fully discussed. It therefore only remains for me to consider, as briefly as possible, the **SPECIAL AMPUTATIONS**. I shall begin with those of the upper extremity.

AMPUTATION OF THE DISTAL PHALANX OF A FINGER is an operation which is seldom performed on the living body. In cases where the part is diseased we generally wait until the bone has become loosened by exfoliation, and then separate it through a free longitudinal incision made in front of or at the side of the finger. By these means the digital extremity is saved, and a more satisfactory result obtained than could be by amputation. When the same part of the finger is injured by an accident to such an extent as to warrant its removal, the soft textures are generally so much destroyed as not to leave sufficient material for the formation of a flap to cover the end of the bone. The operation is one, however, which the student may practise, with advantage to himself, on the dead subject, as giving him neatness and dexterity in performing disarticulation.

In amputating the distal phalanx of the finger, we must keep in mind that the proximal end of the phalanx has a slight projection, which overlaps the articular end of the middle phalanx, when the finger is kept straight; but when the distal phalanx is flexed the relations of the bones are altered, and the articular end of the middle phalanx is then made prominent, and the ligamentous and other soft textures covering it are rendered tense. In performing the operation, the surgeon grasps the extremity of the phalanx between his finger and thumb, flexes it as far as possible, and, with a narrow bistoury, cuts directly upon the projecting end of the middle phalanx, carrying his incision fairly across the posterior aspect of the joint, which is thus opened. He next, with the point of the knife, divides the lateral ligaments so as to free the articular end of the distal phalanx and allow the blade of the knife to be passed in front of it. He then cuts a flap sufficient to cover the stump from the anterior aspect of the finger. On the proceeding may be reversed when the joint cannot be bent.

The surgeon then transfixes the soft parts in front of the joint, and cuts the flap; next opens the articulation from before, divides the short lateral ligaments, and disarticulates the phalanx by cutting backwards. When, owing to disease or injury, soft parts cannot be obtained to cover the end of the middle phalanx, we require to remove a portion of it, and with this view we must shape our flaps from the sound textures, and with the bone-pliers snip off a portion of the bone. If we are thus able to leave the attachment of the superficial flexor tendon, the stump so left will be useful; but when we have to amputate close to, or at, the articulation between the middle and proximal phalanges, it is better to amputate at the metacarpo-phalangeal articulation, as the short stiff stump left would be a deformity, and rather interfere with the use of the other fingers. The only case where it is sometimes advisable to amputate at the junction of the middle and proximal phalanges, is in the case of the forefinger, as the stump serves as a counterpoint to the thumb for prehensile purposes.

AMPUTATION OF THE FINGER at the metacarpo-phalangeal joint is performed thus:—An assistant holds the forearm and wrist firmly with one hand, whilst with the other he separates the fingers on either side of the one to be removed, and bends them so as to keep them out of the way. The surgeon, standing in front of the patient, seizes the finger to be removed with his left hand, and uses it as a lever, to twist it in different directions to render the ligamentous textures tense over the articular end of the phalanx, so as to effect their division more readily. The point of the knife is then placed over the middle line of the metacarpal bone, at least half an inch higher up than the joint. The incision is carried straight down, till near the web between the fingers, when it is made to diverge slightly to one side of the finger, and carried fairly down into the palm, in an oblique direction, converging again towards the middle line; from this point it again diverges towards the web, on the opposite side of the finger, and is then made to pass upwards, converging to and terminating in the original incision on the dorsal aspect of the hand. The extensor tendon, capsular and lateral ligaments, are then divided and disarticulation having been thus effected, the surgeon draws down and extends the finger, and removes it by dividing the flexor tendons at one sweep of his knife. The result is a V-shaped incision, which, when the fingers are approximated, forms a single linear wound. The digital arteries require to be secured, and a point or two of suture introduced to close the wound. When the oval method is adopted, the incision is brought round the root of the finger without cutting into the palm; but this results in a puckered projection—an unseemly appearance, which is avoided by the V-shaped incision. The operation may also be performed with the same result by the method represented in plate XX., fig. 1. The hand being held as before, with the fingers well separated, the surgeon lays the edge of a long narrow bistoury against the tense web close to the finger, and cuts into the joint, and by a rapid movement causes the heel of the knife to cut the palm, and the point of the knife to divide the skin on the dorsal aspect, higher up beyond the joint, twists the

finger as to divide the lateral ligaments, pushes the articular end of the phalanx aside, to allow the knife to pass round it, and completes the operation by cutting through the web of the fingers on the opposite side to where he began his incision. This latter method, though simple and rapidly effected, requires practice, to avoid cross-cutting in rounding the end of the bone to cut outwards. By whatever method the finger has been amputated, care should be taken to preserve the parallelism of the contiguous fingers; and for this purpose I always introduce an elongated pad of lint between the fingers, extending from the points to the articulation of the middle with the proximal phalanx. This prevents their being dragged too closely together, and so impairing the usefulness of the hand. The less dressing over the incision the better.

The mere cartilaginous head of the metacarpal bone may be removed without injury, as some think this facilitates the healing of the wound, although, for my own part, I think it better to leave it on. But unless disease or injury compel us, on no account should the broad portion of the metacarpal bone beyond the head be removed in the case of the middle or ring fingers. It is sometimes advised as leaving a neater hand; but it is quite inadmissible on such a plea. That portion of the bone forms the keystone of the metacarpal arch, and its removal permits the other metacarpal bones to fall inwards, and so the usefulness of the hand is impaired. In the case of the little or forefinger, which are placed laterally, the objection does not exist, and the oblique section of their metacarpal bones beyond the articulation obviates deformity. In the case of the forefinger, the usefulness of the hand is increased rather than impaired by the procedure, as then the middle-finger takes the place of the forefinger in relation to the thumb, more easily than when the projection of the metacarpal bone is present. The method of removing the end of the metacarpal bone of the forefinger is shown in plate XX., fig. 2. The incision of the soft parts is similar to that already described, only placed to the side, so that the cicatrix may be less observable. The section of the bone is best effected by the oblique cutting bone-pliers.

In amputation of a finger, along with a portion of its metacarpal bone, the incision is commenced half-an-inch above the point at which we contemplate dividing the bone, and is carried down along the middle line of the metacarpal bone till it reaches the web of the finger, where it diverges to form the V-incision, as in amputation at the metacarpophalangeal joint. The extensor tendon is cut across, and the metacarpal bone cleared from the soft parts attached to its sides. Its section is then accomplished by Liston's bone-pliers. They should be applied perpendicularly, with their flat surface towards the part to be left. When the bone is divided, the end is raised by means of a hook or forceps, and with the point of the bistoury cutting upon the bone we clear its palmar surface with the least possible interference with the structures in that region, dividing the flexor tendons as we cut out at the web between the fingers. Thus the palm is scarcely touched, and a comparatively superficial wound results. Formerly, when the metacarpal saw was used, the whole thickness of the palm was necessarily

divided to permit of section of the bone. Disarticulation of the fingers at the carpo-metacarpal joint should never be performed if we can leave even the small portion of the metacarpal bone, because, by opening any one of the articulations here, there is communication with the whole range, and inflammation of these irregular articulations is very apt to occur, and serious consequences, both local and general, may follow. In some cases, as for malignant tumours of a metacarpal bone, we may be obliged to disarticulate. In removal of the little finger, with its metacarpal bone, the incision of the soft parts is made along the ulnar aspect of the bone, to avoid deformity on the dorsum of the hand; and in disarticulating, the knife passed between it and the fourth metacarpal bone should have its edge turned towards, and be made to cut upon, that metacarpal bone, as the articulation is oblique, and division of the strong interosseous ligament is most readily effected in this way, and disarticulation is then easily accomplished.

AMPUTATION OF THE THUMB.—Amputation of the distal phalanx, or at the joint between the proximal phalanx and the metacarpal bone of the thumb, is performed in the same way as in the fingers; but the usefulness of even a small portion of the thumb is so great that it is important to save parts of the phalanges by irregular operations, which we would not think of performing on the fingers. Amputation of the thumb, along with its metacarpal bone, is therefore avoided, except in cases of dire necessity. When, however, disarticulation is required, it is not obnoxious to the risks incurred in amputating the other metacarpal bones at their junction with the carpus, for the os trapezium, with which it is articulated, lies on a plane anterior to, and does not implicate the other carpal joints.

The amputation may be performed in various ways. The best plan is by the V-shaped incision, either made by cutting from the skin, as in the case of the fingers, or partly by transfixion, and partly by incision from without (plate XX., figs. 4, 5, and 6). The latter method is more rapid and elegant in execution, and gives the same result. Suppose the left thumb is to be removed: The surgeon grasps its extremity with the forefinger and thumb of his left hand, inserts the point of a long bistoury on the dorsal aspect of, and about half-an-inch above, the carpo-metacarpal joint, and carries the blade obliquely over and towards the ulnar side of the metacarpal bone, with a bold and decided sweep, so as at once to divide the parts forming the web between the thumb and index finger. Next, without withdrawing the point of the bistoury, he bends forward the thumb, as represented in plate XX., fig. 4, so as to relax the muscles forming the ball of the thumb, passes his knife in front of the metacarpal bone, brings its point out at the first incision, and turns its edge almost directly towards the skin; pushes the thumb outwards, as in fig. 5, to render the parts tense, and cuts toward the surface; then, forcibly throwing back the thumb, he opens the joint between the trapezium and metacarpal bone of the thumb, and completes the disarticulation. If the right thumb is to be amputated, the surgeon begins by transfixion, and completes his palmar flap or incision; and then, applying the heel of the knife to the web of the thumb, carries

the blade rapidly through the soft parts on the dorsal aspect, terminating in the first incision at the upper point of transfixion, and concludes by disarticulating, as in the former case. By this method the amputation can be performed with great rapidity, and without withdrawing the knife from the incisions till they are completed. The appearance of the elliptical wound left after disarticulation is shown in plate XX., fig. 6, and the result after the wound has healed is a simple linear cicatrix.

PARTIAL AMPUTATION OF THE HAND is generally required for injury, and consequently the operative procedure must vary in each case, according to the amount and direction of the destruction of parts. Under certain circumstances it may be performed by means of a large flap from the palmar aspect; the metacarpal bones being removed, or sawn through close to the carpal articulation, and the thumb preserved, as represented in plate XX., fig. 7, or by two smaller flaps anterior and posterior. In many cases we must construct the best covering we can by shaping the sound portions of the soft textures, to adapt themselves to the surface of the stump. In all cases where we can save a finger, or a portion of a finger, as an opponent to the thumb, it is most important to do so; but even when the thumb and a portion of the hand can be saved, it should be done, as an artificial opposing power can be fitted to the stump. If, however, the carpo-metacarpal joints of the fingers, and that of the thumb, be injured, and its long flexor tendon torn, there is little use, and considerable risk, in attempting partial amputation, as the movement of the parts would be lost, and unhealthy inflammation and suppuration very likely to occur. Amputation at the wrist, under such circumstances, would be the better plan. Whenever we can avoid opening into the carpo-metacarpal articulation we ought to do so, for reasons already given.

AMPUTATION AT THE WRIST affords excellent results in suitable cases, but these are not of common occurrence. The object in performing this operation, instead of amputating higher up, is not to get a longer stump, but with the view of retaining the movements of pronation and supination, and consequently the greater use of the stump.

To obtain this advantage, the lower radio-ulnar articulation must be saved. Hence there is no use in performing this amputation in cases of disease of the wrist-joint, as in such cases, where amputation is warranted, the lower radio-ulnar articulation is almost always implicated, and we obtain a better stump by amputation of the forearm. The cases suitable for amputation at the wrist are those of injuries in which no part of the hand can be saved, but where the lower radio-ulnar articulation is intact, and where we can obtain sufficient flaps of sound skin to form a covering for the stump. I have performed the operation with very successful results in several such cases. The modified circular method is in my opinion preferable to a flap saved from the palmar aspect, as sometimes recommended.¹ In performing the operation, the assistant who holds the forearm should draw up the integuments tightly. The surgeon then makes a slightly curved inci-

¹ Plate XX., fig. 8.

sion with its convexity downwards, on the dorsum of the wrist. This incision should begin about two inches below the styloid processes of the ulna and radius, and should join, with a gentle curve, a similar incision carried over the forepart of the wrist. These incisions should divide the skin, fat, and fascia; and a few touches with the knife enable the assistant to retract the loosened integuments to a level with, or a little above, the styloid processes. The flexor and extensor tendons are rendered tense, and divided with a circular sweep of the knife below that point. The joint is then opened by dividing the lateral ligament on the outer or inner side, as most convenient for the operator, and disarticulation accomplished from behind forwards. By following this plan, we find that when the operation is completed the flaps come well over the ends of the bones, which are covered with sound skin; whereas, in the ordinary flap method, the styloid processes correspond to and tend to project at the angles of the incisions where the bases of the flaps unite. The vessels requiring ligature, in this operation, are the radial and ulnar; sometimes, but rarely, the terminal twigs of the interosseous artery. During the after-treatment the forearm should be placed in the position between pronation and supination.

AMPUTATION THROUGH THE FOREARM may be performed by the double-flap method, by transfixion, by cutting the flaps from without inwards, so as to avoid redundancy of muscle, or by a long and short flap on Teale's principle. By any of these methods an excellent stump can be obtained, and our choice is often regulated by the conditions demanding the operation. In all cases of primary amputations the plan of cutting our flaps from without inwards answers best; it enables us to shape the flaps more regularly, to avoid injured tissue, and to leave only a very moderate amount of muscular and tendinous structure in the flaps. If we operate by transfixion in such a case, the tendons and muscles loosened from their connections by the injury yield, and are dragged out before the knife and cut irregularly, leaving a redundancy of muscle and ragged surface. In operating, we shape two equal rounded flaps from the anterior and posterior aspects of the forearm, dissect the integuments, fat, and fascia, upwards for at least two inches, the assistant retracting the skin. Then the muscles are divided obliquely upwards to the bone, leaving only a small quantity of muscle on the anterior aspect; the knife is swept round and between the bones, the flaps retracted, the bones sawn through, and the operation completed by securing the vessels, and bringing the flaps into apposition by sutures. When the operation is undertaken for disease, the muscular tissue is generally atrophied and not likely to be redundant, and the tendons being attached inferiorly, the flaps can be cut smoothly and evenly by transfixion, and without disturbance of the natural connection of parts. In performing the double-flap operation by transfixion, the arm being held between pronation and supination, the surgeon grasps the soft parts covering the sides of the forearm, and draws as much of them as possible towards the posterior aspect of the limb, so as to obtain as broad and bulky a posterior flap as possible.

He then transfixes the base of his flap from the radial towards the ulnar side of the limb, and in the case of the right forearm, from the ulnar towards the radial side of the left forearm, making his knife pass close to the posterior surfaces of the bones, and then carries it down so as to cut out a gently-rounded flap about $2\frac{1}{2}$ or 3 inches long. Again he inserts his knife in front, about half-an-inch lower than the former point of transfixion, and cuts a flap to correspond with the posterior one. Both flaps are then forcibly retracted, the knife applied so as to clear the bones at least an inch higher than the point of transfixion, the interosseous textures divided, the bones sawn through, and the operation completed as in the former method. Or the operator may make his second flap by cutting from the skin inwards. In either case, to facilitate the formation of the anterior flap, the assistant should supinate the forearm when the posterior flap is completed. In my own practice I generally cut the posterior flap somewhat longer than the anterior (as represented in plate XXI, fig. 1), so that it may fold over the ends of the bone as the wound heals, and thus the cicatrix does not correspond to the end of the bones. The reason why the knife is entered lower down in transfixing for the second flap is to avoid cross-cutting the base of the first flap, which is otherwise almost certain to occur.

Amputation of the forearm by a long and short flap, on Teale's principle, affords an excellent result, and can be most readily performed as follows:—The forearm being held as formerly described, or slightly supinated, the surgeon, managing the soft parts as in the former case, transfixes in front of the bones, and carries his knife directly down close to the bones, without any inclination to the surface, for about four inches; he does not cut out at this point, but, drawing the knife back in the track of the incision for about two inches, turns its edge directly towards the surface, and cuts out there, so as to form a short square flap; then at the point where the longitudinal incisions terminated he divides all the soft parts on the back part of the forearm with a decided circular sweep of his knife, and separates the long square flap so marked out rapidly up to its base. The bones are then freed and sawn through, and the operation completed, care being taken to adjust the angles of the flaps exactly to each other.

The vessels which require to be secured after amputation of the forearm are the radial, ulnar, and interosseous. The two first are easily seen and secured. The radial lies very superficial and to the outer side of the anterior flap. The ulnar is deeper, and in muscular limbs sometimes retracts a little, but the position of the ulnar nerve at once guides to the vessel. The posterior interosseous and its branches are seen on the posterior flap, but the anterior interosseous, which lies deep, is sometimes difficult to secure, as it retracts amongst the deep muscles. It should always be looked for and secured, as it may cease to bleed at the time of the operation, but is sure to bleed and give rise to trouble afterwards. In this operation, and indeed in all amputations, the nerves should be drawn out a little, and cut short, so as to prevent them becoming adherent over the bone, or in the cicatrix, as shown in plate XVIII, figs. 1 and 2, and so giving rise to a painful stump.

LECTURE LXXVIII.

Amputations in the Upper Extremity *continued*.—At the Elbow-Joint—Amputation of the Upper Arm by the Circular Method : by the Antero-Posterior and Lateral Flap Methods—Teale's Method—Amputation at the Shoulder-Joint : by a large Deltoid Flap ; by Double-Flap Method—Advantages and Disadvantages of each—the Author's own Method : its Advantages—Details of his mode of conducting the Operation—Amputation of Arm and Scapula.

AMPUTATION AT THE ELBOW-JOINT is seldom performed, because, in the cases where it would be desirable, we can rarely get a sufficiency of sound texture to form a covering for the large condyloid end of the bone. In a case in which I operated for the effects of an old burn, I had to form a long flap from the soft parts on the outer side of the forearm, and a flap from that position, or from the inner side, may occasionally be obtained in cases of recent injury, to enable us to get a covering. The preferable method, when we have the choice, is to cut a long flap from the anterior aspect of the joint, and a smaller one posteriorly, either by transfixion immediately below the condyles, and cutting towards the surface so as to form a long flap, as represented in plate XXI., fig. 2, and then dividing the soft parts on the back by a circular cut ; or by cutting a similar flap from the surface inwards, then opening the joint in front, dividing the lateral ligaments, and separating the attachment of the triceps to the olecranon process, so as to complete the removal of the forearm. The result of this method is shown in plate XXI., fig. 3. When the arteries are secured and the nerves cut short, the anterior flap folds over the condyles, and is easily maintained in position.

AMPUTATION OF THE UPPER ARM is perhaps the simplest of all amputations. It may be effected with almost equal success by the old circular or the modified circular method, or by antero-posterior or lateral flaps. In performing the circular operation (plate XXI., figs. 6 and 7), the integument should be well drawn up by an assistant. The operator should then bend his right knee, place his hand and wrist well round the arm, and begin his incision in such a position that, by rising and cutting simultaneously, he can cause the cutting edge of the knife to traverse the circumference of the arm at one sweep. The skin, fat, and fascia, so cut, should then be retracted by the assistant, and the muscular and other textures cut through to the bone by a second circular cut. These should in their turn be drawn upwards, the muscles immediately surrounding the bone projected, and the edge of

the knife applied obliquely, so as to convert the projection into a hollow cone. The soft parts are then held back so as to allow the bone to be sawn as high as exposed. Thus, when the soft parts are restored to their position, they form a hollow cone, of which the section of the bone forms the apex. When healed, the result is a well-covered and very useful stump. The antero-posterior or lateral-flap method is performed by means of transfixion (plate XXI., fig. 8). The soft parts should be grasped and pinched up by the left hand of the operator, so as to enable him to transfix with the blade of the knife close to the bone. He should then cut downwards and outwards through the muscles and skin, making a well-proportioned and neatly-rounded flap. After that has been effected, he should re-insert the knife half-an-inch below the former point of transfixion, close to the bone on the opposite side, and make a second flap to correspond exactly with the first. The flaps should be well retracted, and the bone cleared and cut at a point at least an inch and a half above the angles of the incisions, and the bone sawn through there. All further retraction must then be avoided, lest the periosteum be dragged up from off the divided bone. Many surgical authorities seem to consider it a matter of indifference whether this amputation be performed by antero-posterior or lateral flaps. My own experience leads me to a different conclusion. I think that whenever the upper arm is to be amputated at or near the middle, the method by lateral flaps (external and internal) should be adopted in preference to flaps from the anterior and posterior aspects of the limb. In the former, the line of the base of the external flap crosses the line in which the divided humerus is raised by the action of the deltoid, and consequently the flap folds over the bone as it is raised. But if we adopt the antero-posterior flaps, the line of union of the flaps corresponds to that in which the end of the bone will be raised after section, and hence it is liable to be projected at the angle of incision. In fact, the lateral-flap method in this region has the same advantage that the antero-posterior flaps have in regard to amputation in the thigh.

Teale's method (plate XXI., figs. 4 and 5), by a long external and very short internal flap, answers admirably in cases of disease of the forearm, in which the muscles of the limb are atrophied, or the textures condensed by inflammatory exudation. I have performed it in several such cases with excellent results. The following is the method:—I grasp the soft parts on the outside of the arm, about four inches above the external condyle of the humerus, so as to separate them from the bone, and transfix there, taking care to include fully half the circumference of the limb, and then carry the knife downwards parallel to the bone, without inclining it in any direction, until it arrives at the condyle, when I turn its edge at a right angle to the skin and cut directly outwards, the assistant at the same time drawing up the skin. This long square flap is then held aside, and the soft parts on the inside of the arm divided with a single circular sweep of the knife, about an inch and a half below the point of transfixion, so as to form a short square flap, which is rapidly separated from the bone up to the base of the long flap. Both flaps are then retracted, and the bone cleared and

sawn through about an inch higher up. The vessels are then secured, the nerves cut short, and the flaps carefully adjusted.

AMPUTATION AT THE SHOULDER-JOINT may be performed by various methods. The two which have hitherto been generally adopted are—amputation by a large deltoid flap, and that by two lateral flaps.

Amputation by a large Deltoid Flap consists in cutting, either by transfixion or from without inwards, a large flap, including nearly the whole of the deltoid muscle, the arm being somewhat abducted to enable the surgeon to grasp and cut the flap more easily. The flap is then raised towards its scapular attachments, so as to expose the joint (plate XXII., fig. 1). The assistant then pushes the arm forcibly across the body, so as to render prominent the head and tuberosities of the humerus. The surgeon cuts directly upon the tense capsule and tendons of the capsular muscles, so as to open the articulation; rotating the arm outwards and inwards to divide thoroughly any resisting fibres of the external rotator or subscapularis tendons, turns out the head of the bone from its socket, and passes the knife on the inner side of the bone to divide the soft textures in the axilla, and form a short flap to meet the deltoid. As the surgeon cuts out, the assistant grasps the lower flap between his fingers and thumb, so as to command the axillary vessels before they are divided (plate XXII., fig. 2).

The *Double-Flap* method consists in forming, either by transfixion or rapid dissection, two nearly equal and gently rounded flaps, one from the posterior, the other from the anterior aspect of the shoulder. When transfixion is adopted the patient is brought close to the edge of the table and turned on his side. The affected limb is held somewhat abducted by the assistant, who stands on the opposite side of the table. If the left arm is to be removed, the surgeon introduces his knife from the posterior border of the axilla, passes it obliquely upwards over and close to the head of the humerus, and brings out the point opposite the centre of the acromion process, and cuts downwards so as to form a rounded posterior flap (plate XXII., fig. 3). The flap being raised, exposes the outer surface of the joint, the assistant draws the arm across the chest so as to project the head of the humerus, and the operator divides the capsule and capsular tendons, disarticulates, and then places his knife on the inner side of the bone (plate XXII., fig. 4), and cuts the anterior flap. If the right limb is to be removed the knife is introduced from under the point of the acromion, passed over the head of the humerus, and brought out at the posterior margin of the axilla to form the posterior flap. The vessels are commanded and the operation completed as already described.

This plan of operating is that generally adopted; for although the deltoid flap makes an excellent covering, and admits of great facility in disarticulation, yet the amount of exposed cut surface and the double line of cicatrix contrast unfavourably with the single central linear scar left by the double-flap method. Moreover, the great length of tissue required in the deltoid flap cannot often be obtained in cases requiring amputation at the shoulder.

As regards the method by double-flap, if we look at the result of

such an amputation when recently performed, especially if executed by cutting the textures from without inwards, nothing can look better ;—the two flaps joining neatly in their central line, and sufficiently full to give roundness and to fill up the space under the acromion. But if we look at such a stump some time after the healing process has been effected, the form of the stump will be found much altered, not merely from atrophy of texture common to all stumps, but from retraction of the muscular constituents of the flaps. The fibres of the pectoralis major retracting towards the sternum, and those of the latissimus dorsi and teres major towards the scapula and spine, cause a separation, especially at the lower part of the line of union, and give rise to the formation of a deep ugly hollow under the acromion, as seen in the adjoining woodcut (fig. 154).

In 1856, from a perusal of Professor Langenbeck's and M. Baudens' *Memoirs on Excision of the Shoulder for Gunshot Wounds*, I was induced to adopt the method of excision by a single linear incision made down upon the head and neck of the humerus, beginning immediately external to the coracoid process, instead of the V-shaped incision then practised here. In performing the operation on the living subject, I was struck not only by the ease with which disarticulation could thus be accomplished, but also by observing that from the deltoid being divided so far forward, there was no trouble with bleeding from the trunk of the posterior circumflex artery, which in other methods is always divided and often proves troublesome. In demonstrating the operation to my class at that time, I pointed out that it possessed another advantage—namely, that if, in proceeding to excise the head of the humerus, the injury or disease were found to be more extensive than anticipated, we could form—by simply carrying the incision back towards the posterior fold of the axilla, as I then expressed myself—a very tolerable stump. But when, after performing the excision, I completed the demonstration by converting the excision into an amputation, it struck me that the result would be even better than that of the ordinary method. Accordingly, I determined to adopt it on the first suitable case which I met with.

Some short time afterwards two cases of injury were sent to my care requiring amputation at the shoulder: one the result of a railway accident, shattering and tearing the upper arm; the other, a gunshot wound shattering the tuberosities and shaft. In these two cases I carried out the plan, and the result was so perfect in both that I have since resorted to it in every instance where the nature of the case

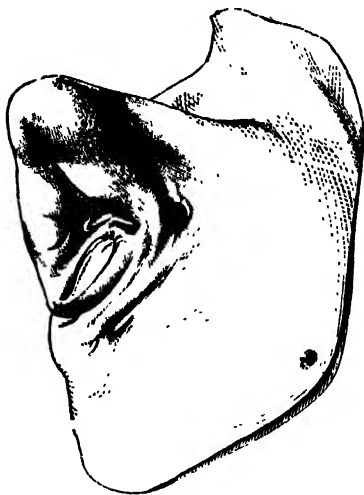


Fig. 154.

admitted of its performance. Indeed, the only instances in which I could not perform it have been two: the one a case of secondary amputation for a burn, in which, from the state of the textures, I was compelled to form the flap entirely from the front; and the other a case requiring amputation from the presence of a malignant tumour, to which the skin was adherent, and where only two very small flaps could be obtained from the sound textures.

What I have already said might almost indicate the method proposed. But to describe it more distinctly and fully.—Supposing the right arm to be the subject of amputation. The arm being slightly abducted, and the head of the humerus rotated outwards, with a broad strong bistoury I cut down upon the inner aspect of the head of the humerus, immediately external to the coracoid process, and carry the incision down through the clavicular fibres of the deltoid and pectoralis major muscles, till I reach the humeral attachment of the latter muscle, which I divide. I then with a gentle curve carry my incision across and fairly through the lower fibres of the deltoid towards, but not through, the posterior border of the axilla. Unless the textures be much torn, I next mark out the line of the lower part of the inner section by carrying an incision, through the *skin and fat only*, from the point where my straight incision terminated, across the inside of the arm, to meet the incision at the outer part. This ensures accuracy in the line of union, but is not essential. If the fibres of the deltoid have been thoroughly divided in the line of incision, the flap so marked out, along with the posterior circumflex artery, which enters its deep surface, can be easily separated by the point of the finger from the bone and joint, and drawn upwards and backwards, so as to expose the head and tuberosities, without further use of the knife. The tendinous insertions of the capsular muscles, the long head of the biceps, and the capsule, are next divided by cutting directly on the tuberosities and head of the bone; and the broad subscapular tendon especially, being very fully exposed by the incision, can be much more easily and completely divided and disarticulation effected, than in the double-flap method. By keeping the large posterior flap out of the way by a broad copper spatula or the fingers of an assistant, and taking care to keep the edge of the knife close to the bone, as in excision, the trunk of the posterior circumflex is protected. Disarticulation is then accomplished, and the limb removed by dividing the remaining soft parts on the axillary aspect. The only vessel which bleeds is the anterior circumflex divided in the first incision, and, if necessary, a pair of catch forceps can be placed on it at once. In regard to the axillary vessels, they can either be compressed by an assistant before completing the division of the soft part on the axillary aspect; or, to avoid all risk, the axillary artery may be exposed, tied, and divided between two ligatures, so as to allow it to retract before dividing the other textures.

In cases where the limb is very muscular, I dissect the skin and fat from the deltoid at the lower part, and then divide the muscular fibres higher up by a second incision, so as to avoid redundancy of muscular tissue. After arresting bleeding, and cutting the nerves short, I bring the edges together with a few points of suture, leaving an opening at the

lower and back part, through which the ligatures are brought out, and the free escape of blood and other discharge permitted.

The dressing I use is very simple, being merely a flat pad of lint secured by a six-tailed split cloth, the tails being tied on the opposite side of the body.

The advantages I claim for this plan are—1st. The fulness and better form of the stump left after the healing, as shown in the results (fig. 155). 2d. The posterior circumflex artery is not divided except in its small terminal branches in front; whereas, both in the large deltoid flap and the double-flap methods, the trunk of the vessel is divided in the early steps of the operation, and, retracting, often gives rise to embarrassing hæmorrhage. In the case of the deltoid single-flap method, the vitality of the flap must be seriously compromised, as it depends chiefly on that vessel for its arterial supply. 3d. The great ease with which disarticulation can be accomplished.



Fig. 155

In advocating the merits of any particular plan of operation, we should be careful not to risk its reputation by claiming superiority for it, under all conditions, over every other plan, or ignoring its disadvantages in certain circumstances. There are cases in which I would prefer the operation by double-flap, such as those for malignant tumour, where we wish to remove all the muscular tissue of the deltoid, and leave nothing but skin flaps. In these cases a single long flap dissected from the subjacent tissues, and depending entirely for nourishment on the vascular supply of its base, is more apt to slough than two smaller ones would be.

I may say, however, after considerable experience in amputation at the shoulder-joint, that there are few cases in which the method I have recommended will not be found suitable; and where it is so, I have no hesitation in advising it as being preferable to any other method I have ever practised.

AMPUTATION OF THE SCAPULA along with the arm is sometimes required in consequence of injury, or for tumours involving both the scapula and humerus, and the results of the cases in which it has been performed fully warrant it. In cases where the operation is necessitated, the surgeon must often require to modify his incisions, according to the position and connections of the disease, or the state of the injured parts. As a general rule, however, the operation is performed by dorsal and pectoral flaps from the axilla, to cover in the exposed surface. The posterior flap is marked out by making a lunated

incision with its convexity directed forwards, commencing along the upper margin of the scapula and passing down over the acromion process to the lower border of the axilla, and again passing back towards the lower part of the base of the scapula. The anterior flap is next marked out by an incision commencing over the clavicle, about an inch nearer the sternum than the coracoid process of the scapula, and carried down over the front of the axilla to its lower border, but there is no necessity for carrying this lower part of the incision towards the sternum further than to curve it slightly. The posterior flap is then to be dissected rapidly back, so as to expose the base of the scapula. The operator should then divide the integuments and humeral attachments of the pectoralis muscle in the line marked out for the anterior flap, and clear and saw through the clavicle on the sternal side of the coraco-clavicular ligament. This will enable him by a few touches of the knife to expose the axillary and supra-scapular vessels, and he can secure them at once, either by the assistant grasping them between his fingers, or, better, by tying them with double ligatures and dividing them. By this procedure the hemorrhage from the great vessels and the sub-scapular and supra-scapular branches will be avoided. The coracoid attachment of the lesser pectoral muscle is then divided so as to free the scapula from its anterior connections. The flaps now being held aside, the attachments of the trapezius to the scapula are divided. The scapula and arm are drawn outwards by the assistant, and the scapular attachments of the serratus magnus, rhomboids, and levator anguli scapulae muscles being stretched, are severed by a stroke of the knife, and the operation completed. The artery of the base of the scapula will be now divided and require ligature. Some advise that when the base of the scapula is exposed by dissecting the posterior flap, the muscles attaching the scapula to the trunk should be divided, the arm and scapula thrown forwards, the clavicle sawn through or disarticulated, and the anterior flap formed in cutting out. I prefer the method I have described, specially as preventing loss of blood as far as possible, but also because the division of the scapular attachment of the serratus is more easily accomplished after the clavicle is sawn through, and the scapula drawn from the side. Removal of the scapula alone, for tumours, will be considered when treating of operations in the axillary region.

LECTURE LXXIX.

Special Amputations continued. —Lower Extremity —Amputation of the Phalanges of the Toes : of the Phalanges of the great Toe with or without its Metatarsal Bone —Partial Amputations of the Foot : of all the Toes : Hey's Operation : Chopart's Operation—Amputation at the Ankle : by Syme's Method : by a large Internal Flap—Other Modifications.

THE amputations of the lower extremity are performed on the same principles as those of the upper, but require to be modified in respect of form and uses of the part left. The dotted lines on the plantar and dorsal aspects of the foot in figures 1 and 2, plate XXIII., indicate the lines of incision generally adopted in amputation of the toes, and partial amputations of the foot.

AMPUTATION OF THE PHALANGES OF THE TOES may be necessitated by a variety of causes, such as injury, cario-necrosis, exostosis, onychia maligna ; or by the toe having become so distorted as to interfere with progression. In the last-mentioned condition I have frequently saved the toe by dividing the flexor or extensor tendons, and other resistant tissues, so as to straighten the toe ; but the after-treatment of such operations is often tedious and troublesome, so that amputation affords a more rapid cure and equally good result, so far as the use of the foot is concerned.

AMPUTATION OF THE TOE is, or should be, always performed at the junction of the phalanges with the metatarsal bone. The lines of incision, and the mode of procedure, are the same as in the corresponding amputation of the finger ; only we must recollect that the joint lies farther removed from the web between the toes than the metacarpophalangeal joint of the fingers. The amputation is accomplished thus :—The point of the bistoury is inserted over the middle line of the toe to be removed, half-an-inch above the joint, carried down, gradually diverging to one side as it approaches the web, and is carried through that into the sole of the foot. From the plantar aspect it is carried upwards, on the opposite side of the toe, converging into the original incision. The strong flexor tendons on the plantar aspect of the toe are divided, the lateral ligaments cut with the point of the knife, and disarticulation effected. When the bleeding is arrested, and the adjoining toes are closely approximated, the loss of the toe is scarcely perceptible. The key to easy disarticulation of the toe is complete division of the strong flexor tendons, and to effect this at

once I extend the toe forcibly upwards so soon as the incisions of the soft parts are completed ; and this enables me to twist the toe so as easily to open the joint and divide the lateral ligaments.

In performing AMPUTATION OF THE PHALANXES OF THE GREAT TOE, we require to save all the integuments we can, to cover in the large distal extremity of the metatarsal bone, and with this view we take care not to make the incision diverge laterally till it has passed for some distance beyond the articular end of the proximal phalanx, or we even carry the incision directly down to near the middle of that phalanx, and then cut circularly round the toe, thus marking out two square flaps of skin. In either mode the internal flap requires to be dissected, the texture forming the web on the outer side divided, and then the flexor tendon cut, and disarticulation accomplished, as in the other toes. The sesamoid bones may require to be removed along with the phalanges. No part of the articular surface or extremity of the metatarsal bone of the great toe should be removed with a view to neatness of the stump, as it forms the anterior extremity of the antero-posterior arch of the foot, and its removal seriously injures both progression and the support which the arched form of the foot affords.

When injury or disease necessitates AMPUTATION OF THE METATARSAL BONE OF THE GREAT TOE, along with its phalanges, the longitudinal incision may be made either on the dorsal or internal aspect of the foot, and carried down to its phalangeal articulation, when it is made to diverge, as in the amputations of the phalanges. If partial removal of the bone is contemplated, its section is accomplished at a healthy point, by means of strong bone-pliers. If disarticulation of the whole bone is necessary, then the incision must commence fully three-fourths of an inch above the articulation between the metatarsal with the internal cuneiform bone. The form of the articulation must be kept in mind. It is not broad, but very deep from the dorsal towards the plantar aspect of the foot, and is most easily opened by cutting the lateral ligaments on the inner side, then inserting the knife perpendicularly, with its edge directed upwards, between the first and second metatarsal bones, so as to divide the strong interosseous ligamentous structure. When this is done, and the great toe and its metatarsal bone forcibly drawn inwards, the disarticulation is most easily effected. Great difficulty has often been met with in arresting the bleeding after partial amputation of this metatarsal bone. This arises from the terminal branch of the dorsal artery being wounded, as it passes down between the first and second metatarsal bones to join the plantar arch. The vessel is wounded, not divided completely, and cannot be seized with the artery forceps, or, when seized, the ligature cannot be tightened in the narrow space between the bones. In some cases I have managed to pass a double ligature by means of an aneurism needle, drag the vessel up and secure it ; but in one instance I had to disarticulate the remaining portion of the bone before the vessel could be secured above and below the wounded point, and this has been required in other cases ; whilst there have been fatal results from

repeated hæmorrhage, when compression has been trusted in to arrest the bleeding. For my own part, I see no great advantage in leaving a small portion of this metatarsal bone, as the articulation is on a line anterior to, and does not communicate with, the other tarso-metatarsal joints, and when complete disarticulation is performed there is no difficulty in seeing and dealing with the wounded artery.

PARTIAL AMPUTATION OF THE FOOT may be performed at different points, and, like the partial amputations of the hand, the operation must be modified according to the circumstances requiring its performance. But, besides the irregular amputations, there are certain amputations of the foot which may be considered as regular operations, such as amputation of all the toes at the metatarso-phalangeal articulations, Hey's amputation at the junction of the tarsus with the metatarsus, and Chopart's amputation at the joint, between the scaphoid and cuboid, with the astragalus and calcaneum.

AMPUTATION OF ALL THE TOES, at their junction with the metatarsus, is best accomplished by shaping a short skin flap from the dorsal aspect of the joint and a larger plantar flap, as represented in plate XXIII., fig. 5, and effecting disarticulation by opening the joints from the inner side of the left and the outer side of the right foot, after dividing freely the textures on their dorsal and plantar surfaces. Owing to the division of the digital branches, a great number of arteries require to be tied in this amputation.

Partial amputation of the foot, leaving the great and second toes, and removing the other toes with their metatarsal bones, or even removal of all the toes and metatarsus with the exception of the great toe, leaves a very useful foot. The flaps must be cut from without inwards, and must be so shaped that a large somewhat triangular flap from the plantar region is obtained to cover in the tarsal range and outer aspect of the metatarsal bone of the great toe, and a smaller dorsal flap to meet it. In two instances I have removed the two outer cuneiform bones and anterior surface of the cuboid, leaving the great toe; and when the wound was healed, and a well-stuffed boot worn, the movements of the foot, after a time, seemed as free as those of the opposite one. When the great and second toes require to be removed, Hey's amputation is preferable to leaving the two or three outer toes, as they gradually curve obliquely inwards, and impede instead of assisting progression.

PARTIAL AMPUTATION OF THE FOOT AT THE TARSO-METatarsal ARTICULATION was first proposed by Hey of Leeds. As performed by him, disarticulation of the metatarsus having been accomplished as far inwards as the internal cuneiform bone, the projecting part of that bone was sawn off, and the foot removed. Lisfranc's modification of the operation consists in disarticulation throughout the whole range of the articulations. It is advisable for the student to practise Lisfranc's method on the subject, so as to gain dexterity in disarticulation. But in operating on the living I would advise Hey's method, in respect

that it is at once easier in execution, and leaves a better stump, by removing the projecting end of the internal cuneiform. The objection, that by doing so we destroy the attachments of the tibialis posticus and anticus, is merely fanciful. These tendons and their expansion are attached to the whole extent of the internal cuneiform bone.

As regards the incisions, they are the same in both methods. The surgeon grasps the foot with his left hand, placing his forefinger and thumb, the one well behind the projection of the metatarsal bone of the fifth toe, the other over the base of the metatarsal bone of the great toe, thus marking the general line of the articulation. He then cuts obliquely from without inwards in the right foot, and from the opposite direction in the left foot, across the integument on the dorsum of the foot, an inch and a half in front of or below the articulation, and by a few touches of the knife frees it so that it can be retracted beyond the joint. Next he shapes a large flap from the plantar region. This flap should be longer on the inner than on the outer side, gently rounded off at its extremity, and should contain all the thickness of the plantar textures. Next, the operator disarticulates by cutting from the fifth metatarsal bone inwards, until the knife is arrested by the head of the second metatarsal bone. Instead of trying to get round that, he attacks the articulation between the internal cuneiform and first metatarsal, by opening it from the inner side. He then plunges his knife perpendicularly between the first and second metatarsal bones, with its edge directed upwards, and moves it backwards and forwards till he feels the strong interosseous ligament give way. He then forcibly depresses the part to be removed, and with a few touches over the head of the second metatarsal bone, the joint is opened, and disarticulation accomplished.

In Hey's method, after disarticulation is so far effected, the saw is applied to remove the projection of the internal cuneiform bone, and thus a more regular surface is left, and the operation much simplified. The plantar flap may be made by transfixion (as in plate XXIII, figs. 6 and 7); but I recommend it to be cut as I have described, as we can then shape it more accurately. The dorsal and plantar arteries require ligature, and also, in general, numerous branches springing from the arch. Some surgeons trust almost entirely to the plantar flap for a covering, but, to say nothing of the impossibility of always obtaining so long a plantar flap, I think it better that the cicatrix should be rather over the front of the stump, where it will be opposed to the soft padding, than on the dorsum of the foot, where it will be exposed to the pressure of the boot.

Chopart's amputation consists in removal of that portion of the foot which lies anterior to the astragalus and os calcis. The general method of procedure and form of the flaps are very similar to that just described. The plantar flap requires to be very long internally, to fold over the exposed articular surface, which is very deep. The disarticulation, however, is very simple as compared with that at the tarso-metatarsal joint: for although, anatomically speaking, the line of articulation between the astragalus and scaphoid is slightly curved, and that between the cuboid and os calcis oblique from within outwards and forwards, yet

practically, as regards disarticulation, when the anterior part of the foot is depressed, the articular surfaces separate so that the line becomes almost transverse from side to side. The operation is performed as follows :—The surgeon ascertains the position of the scaphoid bone, by feeling its projection towards the plantar surface of the foot, and if operating on the right foot places his forefinger upon that point, whilst his thumb rests about three-fourths of an inch behind the projection of the fifth metatarsal bone. He makes a gently curved incision, the convexity towards the toes, across the dorsum of the foot, about an inch and a half in front of the joint, and separates the skin-flap with a few touches of his knife, whilst the assistant retracts it. He next forms the plantar flap, by cutting from without inwards, and then opens the joint from its external aspect, and completes the operation by disarticulating ; or he may, after forming the dorsal flap, disarticulate by depressing the foot forcibly, and cutting up on the joint, and then pass the blade of his knife beneath the bones, and cut out the plantar flap, as represented in Hey's amputation, in plate XXIII., fig. 7 ; but, as I have already said, I prefer shaping and cutting the plantar flap from without, before disarticulating.

Chopart's operation is one which I never perform now. I used to perform it before amputation at the ankle was introduced ; but, though much preferable to amputation through the leg, it never left a very useful stump, and I consider it far inferior to amputation at the ankle. The gastrocnemius and soleus muscles having nothing to counteract them, draw up the heel ; and hence the patient does not rest on the heel but on the fore part of the stump. Again, if the amputation be performed for disease of the tarsus, we leave the two bones which should of all others be removed, as being likely to partake of diseased action, and subsequently require another operation for their removal. If you ever do this operation I would advise you to divide the tendo Achillis at the same time. You would thus equalise the balance between the muscles on the front and back, until adhesion of the divided tendons of the leg had taken place, and so you might modify retraction of the heel.

AMPUTATION AT THE ANKLE JOINT is, both in regard to safety and the formation of a useful stump, perhaps the most successful of all amputations. It may be performed either by Mr. Syme's method or by a large internal flap ; and when the stump is fairly healed, it is very difficult to tell which method has been used—the result is so similar. Mr. Syme's method, as described by himself, is as follows :—“ When the operation is to be performed, pressure should be made on the tibial arteries by the fingers of an assistant, or a tourniquet applied above the ankle. The only instruments required are a knife, of which the blade should not exceed four inches in length, and a saw. The foot being held at a right angle to the leg, the point of the knife is introduced immediately below the malleolar projection of the fibula, rather nearer its posterior than anterior edge, and then carried across the sole of the foot, slightly inclining backwards, to the inner side of the ankle, where it terminates at the point *exactly opposite* its commence-

ment. The extremities of the incision thus formed are then joined by another passing in front of the joint. The operator next proceeds to detach the flap from the bone, and for this purpose, having placed the fingers of his left hand over the prominence of the *os calcis*, and inserted the point of his thumb between the edges of the plantar incision, guides the knife between the bone and nail of the thumb, taking great care to cut parallel with the bone, and to avoid scoring or laceration of the integuments. He then opens the joint in front, carries his knife outwards and downwards on each side of the astragalus, so as to divide the lateral ligaments, and thus completes the disarticulation. Lastly, the knife is carried round the extremities of the tibia and fibula, so as to afford room for applying the saw, by means of which the articular projections are removed, together with the thin connecting slice of bone covered by cartilage. The vessels being then tied, and the edges of the wound stitched together, a piece of wet lint is applied lightly over the stump, without any bandage, so as to avoid the risk of undue pressure in the event of the cavity becoming distended with blood, which would be apt to occasion sloughing of the flap. When recovery is completed, the stump has a bulbous form, from the thick cushion of dense textures that covers the heel, and readily admits of being fitted with a boot." (See plate XXIII., figs. 1, 2, 9, 10, and 11.)

AMPUTATION BY LARGE INTERNAL FLAP (plate XXIII., figs. 12 and 13), is performed as follows:— Suppose the right foot is to be removed, it is held firmly, resting on its outside. The surgeon inserts his knife over the tendo Achillis, and cuts obliquely across that tendon towards the outer and plantar aspect of the heel, then curves his incision inwards across the sole of the foot, and then upwards in front of the internal malleolus, till it crosses the tendon of the tibialis anticus, so as to form the large internal plantar flap. Next, without removing his knife from the incision, he continues to cut across the dorsal aspect of the foot, about an inch below the ankle, until the incision terminates at the point where he commenced the operation. The flaps are then rapidly dissected up, taking care to avoid injuring the posterior tibial artery. Finally, disarticulation is accomplished, a section of the tibia and fibula removed as in Syme's method, and the vessels secured. When the patient rests on his side, the flap lies in position almost by its own weight, and any serous or other discharge escapes very readily, so that the stump generally heals more quickly and solidly than when the other plan is adopted, in which discharges are apt to accumulate in the heel-flap. To obviate this, Mr. Syme used at one time to make a counter-opening, to allow free escape. That, however, is unnecessary, for if, after Syme's operation, the patient be made to rest on his side instead of being laid on his back, the discharges will escape at the fibular angle of the incision, which should be left a little open.

Various modifications of amputation at the ankle have been proposed, such as leaving the upper portion of the astragalus, in connection with the malleoli, instead of disarticulating it. Pirigoff's amputation consists in making the incisions somewhat in the same way as in Syme's method, except that the line of the plantar flap is well in front

of the malleoli. After dissecting this flap beyond the line of the joint, but not from the heel, he disarticulates, and next saws through that part of the os calcis behind the joint, then saws off the ends of the tibia and fibula, as in the other methods, and applies the section of the calcaneum, retained in the plantar flap, to the section of the tibia and fibula, so that the osseous surfaces may unite. From what I have seen of such modifications, I consider them as anything but improvements on either of the methods I have described, because they retain portions of bone, which, in cases of caries, have a predilection to become, if they be not already, affected by the disease, and because the stump left is by no means better fitted to support the weight of the body, nor so well adapted for progression.

LECTURE LXXX.

Amputation of the Leg : by long Posterior Flap ; Primary and Secondary ; by the Circular Method ; by Teale's Method - Amputation at the Knee-Joint - Amputation at the Thigh by Transfixion : by long Anterior Flap ; Author's Method ; by Circular Method—Amputation at the Hip-Joint ; Advantages - Steps of the Operation---Artificial Limbs.

AMPUTATION OF THE LEG may be performed either by the modified circular method, or by the long posterior flap, or by Teale's method of a long anterior skin flap. When the operation is performed for chronic disease, the muscles of the calf are generally atrophied and somewhat condensed ; and in such cases the long posterior flap method is, I consider, preferable to any other, as affording a well-covered stump on which the weight of the body may rest ; and the patient is thus enabled to walk with ease. This plan of operating, and its results, are shown in plate XXIV. If the right leg is to be amputated, the operator stands on the inner side of the limb, places the heel of his knife over the outer margin of the fibula, carries the blade across the front of the leg until the point reaches a little behind the inner edge of the tibia ; then, without moving the point from the incision, he transfixes the limb, and cuts out a long gently-rounded flap from the calf of the leg. The skin and flap are retracted, the bones cleared and sawn through a little higher than the point of transfixion. The point of election for section of the bones should be about the middle of the leg. In young patients or females, where there is a considerable amount of fat, a flap of skin may be obtained, by cutting from without inwards, and the limb removed near its lower third ; but cases requiring amputation of the leg seldom admit of the operation being performed lower than the middle of the leg.

In sawing the bones it is sometimes recommended to remove the anterior angle formed by the section of the tibia, by first sawing the tibia obliquely before sawing it through ; but I have found this to expose the bone too high beyond the section, and now, when I find the angle very acute, I remove it, after section, either with the bone-pliers or a small saw. A good deal has been written about the difficulty of transfixion in this operation, and the risk of passing the knife between instead of behind the bones : but, with ordinary care, and keeping in mind the oblique position of the fibula in relation to the tibia, there should be little risk of such an occurrence. I have never felt any difficulty, nor have I ever seen it happen, even with students practising the operation on the subject.

In cases of primary amputation of the leg, or when the muscles of the calf are largely developed, the transfixion method is objectionable, owing to the redundancy of muscle left not only preventing the parts being brought and kept in position, but as leading to tension and supuration, and increased risk to the patient. This result is depicted in plate XVIII., fig. 5, from a sketch taken by the late Sir Charles Bell, to show the disadvantage of the flap method. In such cases I have occasionally made my assistant retract the skin, and then removed the redundant muscle with a single stroke of the knife. Still, in primary amputations, I prefer the modified circular method, or rather a short anterior and longer posterior flap of skin cut from without inwards, a very small amount of muscle only being retained near the bones. The soft parts are then retracted fully, and the bones sawn higher up. In this amputation, when performed high up in the leg, difficulty is sometimes encountered in securing the posterior tibial artery. It retracts amongst the deep muscles, and cannot be readily seen or secured. In such circumstances, the best plan is to divide the interosseous membrane, and dissect so as to expose and tie the vessel. In the after-treatment of the stump the patient should be made to lie on his side, which tends to obviate the pressure of the tibia on the anterior skin flap, and also allows the posterior flap to lie in better position to the bones.

The method of a long anterior skin flap, proposed by Mr. Teale, I do not consider to be well suited to the leg. I have tried it in one or two cases, but its result is not equal to the long posterior flap, and there is a greater risk of the tibia causing ulceration; and the long thin flap is liable to suffer from want of vascular supply.

AMPUTATION AT THE KNEE-JOINT, when we have an opportunity of performing it in proper cases, should always be done in preference to amputating higher up. The difficulty is that, from the great bulk of the articular surface of the femur, we can seldom, in cases of injury, obtain a sufficiency of soft parts for a covering. The operation is performed by cutting a long and broad anterior flap of skin, beginning below the tuberosity of the tibia, and dissecting it up, from off the patella. Next, we divide the integuments on the posterior part of the limb, very little higher up, and, when the skin is retracted for about two inches, the remaining soft parts in the popliteal space are divided obliquely towards the posterior surface of the joint. Then the knee is forcibly bent, the attachments of the patella, lateral, crucial, and posterior ligaments divided, and disarticulation of the leg completed, the vessels secured, and the flaps adjusted and retained by sutures.

When considering the general subject of amputation, I took AMPUTATION OF THE THIGH as the example of the different methods of operating; and hence, as these have been already fully described, as regards the principles on which they are performed, I need do no more than very briefly describe the manual procedure adopted in the principal methods.

Amputation by double flaps formed by transfixion. —The flaps

should always be anterior and posterior, and are formed thus:—The operator stands on the inner side of the right and the outer side of the left limb, so as to command the bone whilst sawing it. An assistant, standing on the opposite side, places the palm of his hand against the posterior part of the thigh, at the part to be operated on, so as to press upwards the soft parts, and relax those on the anterior aspect of the limb, to enable the operator to grasp and raise them from the bone, and thus to transfix with greater ease and obtain a broader flap. The limb below the knee is to be in this, as in all amputations, firmly supported by an assistant, seated in front of the patient. The surgeon transfixes the thigh, about an inch and a half below the point he intends to saw through the bone, and cuts out a broad and rounded flap, re-inserts the knife an inch lower than the first point of transfixion, and cuts the second flap from the posterior part of the thigh. Both flaps are retracted, and the assistant supporting the limb raises it a little, to cause the bone to be projected fully. Then the point of the knife is used to clear the bone higher up, and the saw applied to the highest point where the bone is exposed, and close to its attachments to the soft parts. So soon as the bone is sawn through, the assistant must avoid further retraction of the flaps, lest the periosteum be dragged upwards, and leave the bone denuded. The arteries are then tied: the femoral, at any point below the middle of the thigh, will be found on the surface of the posterior flap, towards its inner side, the vein lying behind it; the terminal branch of the profunda will be found close to the posterior surface of the bone and rather to its outer side. The muscular and cutaneous branches, often very numerous, must be tied where they are seen to jet or ooze. The flaps are then cleansed, placed and retained in apposition by sutures, and supported by compresses of lint, and a roller, to support the flaps; the line of incision over the end of the stump being left uncovered. As regards the relative length of the flaps—in Mr. Liston's method the anterior flap is the shorter, and the posterior is cut long, to allow for its greater retraction to equalise the length of the flaps after the operation is completed. The line of his incision for the posterior flap is shown by the lower dotted line in figure 19, plate XXIV. The modification of Liston's plan, which I used to practise before adopting the long anterior flap, and which I still practise in some cases, is to cut the anterior flap longer than the posterior. The upper curved dotted line, in the plate already referred to, represents my line for the posterior flap. The anterior flap is thus drawn more over the end of the femur after cicatrization of the stump.

I have already fully described my method by the long anterior flap, and given my reasons for adopting it. The manual procedure is as follows:—The limb being held as in the other methods, the surgeon standing on the inner side of the right, or on the outside of the left limb, measures with his eye the breadth of half the circumference of the thigh, inserts his knife into the side of the limb, immediately above the outer or inner condyle, according as he is operating on the right or left thigh, carries the incision down to below the lower margin of the patella, sweeps the knife across the front of the knee with a gentle

curve, and terminates the incision on the opposite side of the limb, on a level with the point where he entered his knife at first. The large flap, so marked out, is dissected rapidly upwards from off the patella and front of the joint. On clearing the upper margin of the patella, the surgeon cuts deeply and obliquely upwards, so as to retain muscular structure, and as much thickness of substance as possible in the upper part of the flap. He then applies the edge of his knife to the textures on the posterior aspect of the limb, about three inches below the base of the anterior flap, and cuts a convex flap, dividing the soft parts obliquely to the bone. The soft parts are then retracted, and the femur sawn through just above the condyles; the vessels secured and flap retained by stitches; but there is no need to apply any bandage or complicated dressing; all that is required is to carry out the treatment by the open method, described at page 664, unless the antiseptic method be preferred.

CIRCULAR AMPUTATION OF THE THIGH is so exactly similar to the same operation in the upper arm, that it need not be further described here. The modification of the circular method proposed by Mr. Syme will be found fully described in Lecture LXXIII., page 654.

AMPUTATION AT THE HIP-JOINT is undoubtedly one of the most formidable operations of surgery, and demands for its proper performance decision and rapidity in operating. The idea seems lately to have entered some minds that the shock will be diminished if amputation through the trochanters be first performed, and then the head of the bone dissected out and disarticulated. I can hardly conceive anything more likely to increase shock than a prolonged operation, or rather double operation; and the difficulty of dissecting out the head and neck of the femur, after section through the trochanters, is very great. In one of my own cases I was unwillingly obliged to disarticulate after this fashion, the shaft being separated at the trochanters by diseased action; and I found it by no means an easy matter, as it is difficult by any artificial means to compensate for the loss of the leverage of the thigh-bone. Judging from three of my successful cases, rapidity of execution does not seem to increase shock, for in one, disarticulation was performed in ten seconds; in another, in fifteen seconds; and in the primary amputation, which was more complicated, it was effected in less than thirty seconds. I think the proposal I have alluded to must have arisen from confounding two things which are essentially different. It is quite true that in cases where amputation has been previously performed at the upper part of the leg or through the thigh, and in which, at some subsequent period, return of the disease has necessitated amputation at the hip-joint, the risk and shock are very much diminished, and the reasons for this are obvious; but that is a very different thing from performing first one and then a second operation at the same time, with a view to diminish shock.

I have no hesitation in saying that, from my own experience, rapidity of execution in this operation is of great importance, as diminishing the risk from shock and loss of blood; and in cases of tumours,

where we have the leverage of the whole limb, the disarticulation may be accomplished in from ten to thirty seconds. The chief things to be attended to for its rapid (not hurried) performance are—attention to the position of the patient; that the hip projects well over the table, whilst the pelvis is kept firmly secured, so as to prevent the body receding: this allows the limb to be fully depressed after the anterior flap is formed, and also facilitates the other movements necessary for enabling the knife to be passed readily beyond the trochanter major so as to cut the posterior flap. The direction given to the knife in passing it across the front of the limb to form the anterior flap is all-important as to the ease with which the subsequent steps will be accomplished.

Operation.—In operating on the right limb, the surgeon, standing on the inside of the limb, which must be abducted, and slightly flexed on the pelvis, should enter the knife immediately in front of the tuber ischii, and carry it steadily in an oblique direction across the front of the joint to a point nearly midway between the great trochanter and crest of the ilium, and cut a rounded flap of sufficient length from the anterior surface of the limb. In doing this, great care must be taken to make the knife pass close in front of the head of the femur, and to turn its edge obliquely towards the joint; so that, when the flap is formed and raised, the capsule will be found to be opened, and when the limb is forcibly depressed, the head of the femur either at once starts out, or a single cut upon it divides the remaining portion of the capsular and round ligaments. Then nothing remains to be done but to clear the trochanter major, and passing the knife behind it and the head of the bone to form a posterior flap, somewhat shorter than the anterior. (Plate XXIV., figs. 21 and 22.)

In performing the operation on the left thigh, the surgeon should stand on the outer side of the limb, enter his knife about midway between the trochanter major and the superior spine of the ilium, carry it obliquely across the front of the joint, transfix and bring out the point immediately above and in front of the tuberosity of the ischium. Cut out the long anterior flap, and proceed as already described on the amputation of the right limb.

The hæmorrhage is controlled during the operation either by applying an abdominal tourniquet, or by the strong india-rubber compressor, encircling the abdomen so as to compress the abdominal aorta. The abdominal parietes and back are protected by a soft towel, and a pad of sponge and a folded towel are placed over the artery.

I used this method lately, and it effectually checked all bleeding, and produced no bad effects. The femoral artery should always be commanded, even when an abdominal tourniquet is employed, as it may slip, or require to be removed from interfering with respiration. When the anterior flap is cut, the assistant grasps it so as to command the vessels completely; and on disarticulation being accomplished, another assistant compresses the surface of the posterior flap with a large sponge, raising it from time to time to allow the bleeding points to be secured. Then the femoral vessels are tied, the nerves cut short, and the flaps approximated. Two flat compresses of lint, supported by a broad spica bandage, are applied to maintain the surfaces in

apposition, and prevent blood accumulating in the stump. The greater part of the line of union is left uncovered, and one suture left untied to allow any blood to escape, so that attention may be at once directed to any excess of oozing which may take place on reaction.

Method in Special Cases.—In some cases, after excision of the head of the femur for disease of the hip-joint, it may happen that from the upper part of the shaft becoming diseased, and the patient exhausted by continued discharge and pain, removal of the limb at the hip may be required. In such cases the operation may be accomplished without any loss of blood, and also with less exposure of cut surface, by the following method:—A long, sharp-pointed steel skewer is passed across the upper part of the limb, well behind the great vessels, through the opening already existing. A piece of india-rubber tubing is applied in the form of figure-of-8, so as to constrict the parts on the posterior aspect of the limb, and then a separate piece of tubing is applied so as to constrict the textures on the anterior aspect, so that the circulation is thus completely commanded. A circular compressor applied round the thigh below the line of amputation obviates all bleeding when the textures are divided. The surgeon, with a short knife such as that used for amputation at the ankle, cuts from the outside directly upon the great trochanter and shaft of the femur to an extent sufficient to form a covering. The limb is then brought across the opposite one, so as to tilt out the upper part of the femur, and then, keeping the edge of the knife cutting on the inner aspect of the bone, it is cleared on its internal side. Then all that the operator has to do to complete the amputation is to cut through the soft parts, at the lowest point where they are separated from the femur. This may be effected with one circular sweep of the knife, but a neater result is obtained by shaping the margins slightly convex. The great vessels are tied where they are divided by the circular incision; then the anterior india-rubber is removed from the limb, and any vessels which bleed are secured; next, the posterior compressing band is taken off, the skewer withdrawn, and the bleeding vessels tied. As to arrest of bleeding, it will be observed that there is no deep or large cut surface to furnish much hæmorrhage. The great vessels are divided in the circular division at the extremity of the stump, and the manner in which the shaft of the femur is separated from the soft part causes only a superficial wound on the outside of the stump. There is no surfaces, as when flaps are formed.

In some cases, when displacement and partial ankylosis of the head of the femur had taken place, and secondary disease, at a later period of life, demanded amputation, I have first excised the displaced and ankylosed head of the femur, and then performed amputation, as described above.

The space already occupied by the subject of amputation forbids me entering on that of ARTIFICIAL LIMBS, which I felt very much tempted to do had my limits permitted. The form and usefulness of many well-formed stumps are marred by badly-fitted artificial substitutes—wonderful pieces of mechanism sometimes, but not serviceable for the purposes for which they are wanted. I allude especially to

those intended as substitutes after removal of the thigh. The mechan-ists in general seem slow in taking the trouble to understand the difference of adaptation required in an artificial limb, for a stump, the end of which is intended to support directly a considerable part of the weight of the body, and one in which the position of the cicatrix unfits it for bearing pressure, and so all are arranged on the old system for the latter class, and the advantages of a long thigh-stump, obtained by the anterior-flap method, are in a great measure lost. The simplest and best artificial limb adapted for a special purpose is one described by Mr. Pollock, as suited for stumps formed by amputation at the knee-joint, and constructed by Mr. Blaise. I have only seen photographs of it, for which I am indebted to the politeness of Mr. Pollock ; but judging from these, it seems at once simple and perfect for the purpose, and I should think very little difficulty would be found in adapting it to suit the long thigh-stump formed by the method of amputation I have recommended, or that formed by the methods of Teale and Carden. In regard to artificial limbs for the upper extremity, they may be made ornamental, and, to some extent, even useful ; but no one will be Utopian enough to expect that any mechanical adaptation will form a substitute for the hand.



AMPUTATION OF LEG.

FROM ORIGINAL SKETCH BY ROWLANDSON, 1793.

CLINICAL CASES

ILLUSTRATING THE SUBJECT OF AMPUTATION.

SUCCESSFUL CASE OF PRIMARY AMPUTATION AT THE HIP-JOINT.

On the 3d of September 1863, Robert Davidson, a young lad, was thrown from a truck which had been suddenly set in motion, and fell in front of it, both wheels passing obliquely over the upper part of the left thigh, just below the pelvis. The accident happened at the Melrose Station, and the boy was seen almost immediately by Dr. Clarkson, who adjusted the limb, and had him conveyed to his home at Newstead, about a mile distant. About two hours afterwards, Drs. Brown and Smith accompanied Dr. Clarkson to see the case. The boy had recovered in a great measure from the shock, but his pulse was still very weak. On examination, there was found a large contused flesh wound at the upper and inner part of the left thigh, exposing the muscles, which were much torn and bruised, and allowing the finger to be passed deeply into the tissues of the limb. The femur at and below the trochanters was felt to be much shattered. The foot was cold, and pulsation in the popliteal and tibial arteries extremely weak, but there had been no great amount of blood lost.

As it appeared to the medical attendants that the boy's only chance of life was removal of the limb by amputation at the hip-joint, I was telegraphed for, and arrived at the patient's house about 9 P.M. On examination of the injury, the contused and lacerated state of the soft parts, the shattered condition of the femur, and the consideration of the great force by which the injury had been caused, left no doubt as to the course to be pursued. I at once coincided in the opinion which his medical attendants had expressed, although, from the depressed state of the young patient, and the proximity of the injury to the trunk, the chances of success seemed very small.

The boy's parents having given their consent, I proceeded to perform the operation under circumstances not the most favourable. The room was small, and the only light available was from a small lamp on the mantelpiece, and two small candles held by a non-professional assistant; a wax taper I had brought with me was kept in reserve for exigencies. I had brought the abdominal compressor, but as it could not be applied so as to command thoroughly the circulation, Dr. Smith took charge of compressing the common femoral on the brim of the pelvis, and I instructed one of the patient's friends how to command the bleeding from the posterior flap, by grasping it with one hand and pressing a large sponge upon its surface. Dr. Brown took charge of the movements of the limb, whilst Dr. Clarkson administered the

chloroform. When the boy was brought under its influence I entered my knife between the trochanter major and the anterior superior spine of the ilium, and carrying it obliquely across the thigh, brought the point out a little above the tuberosity of the ischium, cutting a short anterior flap. Dr. Brown then rotated and depressed the limb, with the view of facilitating disarticulation; but owing to the shattered state of the femur this movement did not produce the desired effect. Fortunately, however, this caused no great delay, for my knife had opened the joint in passing across the limb; and by grasping the upper broken fragment of the bone, so as to project the head, I completed the disarticulation, and cut as large a posterior flap as I could obtain from the uninjured parts. Some vessels on the posterior flap were first secured, and then the great vessels in the anterior flap,—the vein being included in a ligature. I then removed some contused and doubtful-looking portions of muscle. After all bleeding had been arrested, the flaps were brought together with sutures; and, considering the nature of the parts from which the flaps were formed, they fitted tolerably well. The stump was then dressed, and the patient placed in bed, hot bottles applied, and stimulants administered, as he was very weak. He lost very little blood during the operation, as I ascertained by carefully collecting the blood from the stone floor, when it was found to amount to less than half a small teacupful; and altogether, with what was in the sponges, to about five ounces at most. After waiting till the little patient had completely rallied from the chloroform, and had got an opiate administered, I left him in the charge of Dr. Smith, who remained with him all night, and to whom I am indebted for the following report of the progress of the case:—

Examination of Limb after Removal.—On examination of the limb after removal, the femur, from the large trochanter downwards for about two inches, was found to be broken into numerous fragments, the ragged edges of which were embedded in the surrounding soft parts. The muscles and other structures were much bruised and torn, but there was no direct injury to the large vessels or nerves.

Progress of Case.—4th September. During the night patient was very restless and delirious. Pulse 134, weak. A little brandy and water was administered at intervals, but was vomited. No reactionary hæmorrhage of any consequence. *Vespere.*—Still restless, with delirium. Pulse 130. To have opiate with a few drops tinc. mur. ferr.

5th.—Restless night. Pulse 130, very weak and thready. Sunken aspect of countenance. Beef-tea, brandy, and milk, given in small quantities frequently.

6th.—Rather better. Slept a little. Less delirium. Pulse 108, stronger. Wound has healthy appearance, except at the bruised part of the flap, which looks sloughy.

7th.—Pulse 108. Sloughing action extending slightly on posterior flap. Fætid sero-purulent discharge. Chloride of soda lotion. Opiate.

8th.—Pulse 90. No delirium. Line of demarcation formed, showing slough rather exceeding a square inch in extent. Purulent discharge copious and less fætid.

9th.—All the stitches removed, and the flaps brought together as well as possible by strips of plaster. Pulse 100.

12th.—Sloughs separated. An attack of diarrhœa. Slight delirium. Opiate.

14th.—Pulse 108. Diarrhœa less. Stump looking healthy. Diet for the most part milk, beef-tea, wine, with a little brandy.

16th.—Doing well.

20th.—Pulse has risen to 120. Had a restless night, with delirium. Raw surface of stump covered with patches of whitish semi-translucent membrane of pretty tough consistence. Copious purulent discharge. Stimulants given in increased quantity.¹

21st.—Pulse 120. Occasional delirium. Wound has same appearance.

23d.—Pulse 118. Wound has less of its diphtheritic-looking covering.

27th.—Stump looks healthy, and is cicatrising round the edges. Dressed with sulphate of zinc lotion. Pulse still high, 116. Sleeps well. Appetite indifferent.

1st October.—Pulse 100. Doing well.

4th.—Pulse 102.

From this time recovery was slow but uninterrupted. The patient gained strength gradually, with the aid of tonics, wine, etc. The femoral ligature did not fall off till 4th November, two months after the operation, having evidently been retained for some time after its separation from the vessel by the granulations surrounding it. By the middle of December the stump was healed, with the exception of a mere spot. Two or three weeks later this also had closed, and the patient was able to move about with the aid of crutches.

Remarks.—I have thought this case would be interesting, because successful results in cases of amputation at the hip-joint are rare, and in primary amputations exceedingly so. In the last edition of Cooper's *Surgical Dictionary*, it is stated that there have been six cases of primary amputation at the hip performed in Great Britain since 1838, and all of them proved fatal. In the Crimea fourteen amputations at the hip-joint were performed by British surgeons for injury, and not one recovered; and in the Punjaub in 1848-49, three cases occurred, with the same unfavourable result. And, so far as I am aware, the case I have just detailed is the first successful primary amputation at the hip-joint in Scotland. But the principal interest which such a case possesses, seems to me to be the consideration of those circumstances or conditions which may have conduced to the successful result, and which may influence our practice in similar cases.

The age of the patient may seem to explain the favourable result. It has been said that in young patients, from the greater remedial powers of nature, and the smaller surface exposed by the operation in them, the operation is likely to be more successful; but this is very questionable. The remedial powers in young persons are no doubt great, when once a certain point has been passed; but the first effects of shock, either from accident or operation, and especially the loss of blood, are not well borne by such patients, and these, together with the irritability of constitution, which is often marked, in a great measure I think counterbalance the remedial powers observed in them. Then, as to the less amount of cut surface, though less absolutely, it is quite as great comparatively to the size and vital powers of the patient. The amount of mutilation, the consequent derangement of the circulation, and all the risks depending on these conditions, are at least as great relatively in the lad as in the adult. From what I have observed in the case of primary amputations in young children, the patients

¹ Dr. Brown informs me that diphtheria was prevailing in the district at the time.

sometimes sink rapidly and without any apparent cause, whilst even the successful cases are often attended at first with as urgent constitutional disturbance as in adults. Indeed, the state of the patient whose case I have recorded, shows how great was the constitutional shock during the first four days, and how slowly full reaction set in. The true causes of success will, I think, be found in the nature of the injury, the small amount of blood lost, and the comparatively little shock he was subjected to after the occurrence of the accident.

As to the character of the injury. Although so excessively severe as to necessitate amputation, and though in dangerous proximity to the trunk, the destructive force was limited to the parts over which the wheels had passed,—there was no laceration of the limb below, nor of the abdominal region above, and there was little bleeding from the contused wound. Then the boy was seen immediately, the limb adjusted, and he was conveyed at once to his own home, so that he scarcely suffered any secondary shock from removal. Now, let me contrast these conditions with those of another case occurring in my hospital practice, and some of the causes which greatly determine the results will be pretty apparent. A man was admitted under my care in consequence of an injury inflicted by the explosion of a large iron flask containing gunpowder. The flask, the metal of which was about a quarter of an inch thick, had been in close contact with his body when it exploded, and the wound was therefore similar to that caused by the bursting of a shell. The thigh was almost separated from the trunk at the upper and inner part. The pectineus, adductors, and the hamstring muscles, at their origins from the tuber ischii, were divided and torn into shreds, whilst the front of the abdomen and lower part of the thorax were severely scorched by the explosion. The femoral artery, largely exposed, had escaped injury, but the vein seemed twisted and injured, as the blood was coagulated in it. There had been considerable bleeding from the arterial branches divided, and slow oozing into the textures of the limb was going on when the patient was brought into the hospital. The accident had occurred in Lanarkshire, and the patient had to be conveyed partly by road, and then by railway to Edinburgh. In this case also the only chance of life and relief from suffering was removal of the limb at the hip; but after rallying during the first twenty-four hours, he died on the third day. Here, in contrast to the case of the boy, we see the disadvantages of a long and tedious journey, and renewal of shock from time to time, from the unavoidable movements in being so conveyed to town; the slow loss of blood from oozing into the tissues of the limb; the extent and severity of the wound, and the scorching of the abdomen and chest, an injury very dangerous in itself;—such circumstances are sufficient, I think, to explain the fatal result,—and, from what I have observed in cases of primary amputations, these are conditions which, according as they are present in greater or less degree, most materially influence the success of such operations.

Perhaps it may seem that I do not sufficiently appreciate the importance of the patient enjoying the benefits of pure country air,

instead of that of a hospital ward. But whilst it is perfectly true that there is much need of doing all we can to improve the ventilation of our hospitals, the dwellings of the working-classes in the country are not always, or even generally, models of ventilation. In the case of the boy, the room he occupied was a small closet, low in the ceiling, just large enough to contain a small fixed bedstead, leaving barely room to pass between the bed and the wall,—its only means of ventilation a small window, and the door opening into the common room of the family, which also contained beds, so that whatever the purity of air in the country round, he did not enjoy much of it. Without denying the bad effects of vitiated air in hospital wards, and the necessity of doing all we can to remove that cause of mischief, I cannot help saying that a good deal of nonsense is spoken and written about the dangers of operations in hospitals as compared with those in private practice, as if all depended on hospital air alone. From some of the discussions on the subject by correspondents in the weekly medical journals, and from recent proposed methods of ascertaining the results of surgical operations in hospitals, it would almost seem as if some statisticians had so crammed their brains with mere figures as to have no room left for a single idea, or even so small a glimmering of common sense as to make allowance for the nature and class of cases admitted into great hospitals, or to pay the least attention to the circumstances under which the patients are when admitted.

As to the operation itself, the difficulties were only such as must always more or less present themselves in operating in cases of injury, where the lacerated textures prevent us from obtaining regular flaps, and where the comminution of the bone deprives the operator of the power of leverage to facilitate disarticulation. There was, however, comparatively little difficulty here, although the fragment I had to grasp was small, because I had taken care to pass the knife deeply, so as to open the front of the joint in cutting the anterior flap, and by doing so the difficulty of disarticulating was much diminished. There was, however, a condition present which I have seen cause serious difficulty in amputation of the thigh for compound comminuted fractures when transfixion was attempted, I mean the dragging up of the lower part of the femur, by the hamstring and adductor muscles, and the projection of the trochanteric or upper part by the psoas and iliacus flexing it on the pelvis, so as to project it towards the skin, and prevent the knife being carried down in cutting outwards. In this case it was of no consequence, because the soft parts in front were so injured that I could not get a long anterior flap; but, supposing the tissues to have been sufficiently sound, the bone was so tilted forward that I could not have carried the knife onwards. In such cases I would strongly recommend cutting the flap of integument and fascia from without, and then transfixing across the joint, or to cut the flap altogether from without inwards, as is now generally done in primary amputations of the limbs. In regard to the vessels, it will be observed that in this, as in a former successful case of hip-joint amputation for disease, I put a ligature on the femoral vein as well as on the artery. In my former case I did so

with great dread of the result, but I have since done it in some cases of amputation, and as they all did well, I am sometimes inclined to think that, instead of being hurtful, as I used to dread, it may possibly be useful as preventing imbibition or absorption of purulent or sanious matter from a large wounded surface; but I confess I have still so much of lingering prejudice that I do not like to try or urge the practice generally. I have, however, no hesitation now in applying a ligature when venous bleeding is troublesome after amputation.

AMPUTATION AT THE HIP-JOINT.

L. S. was admitted into the Royal Infirmary on the 13th of July 1862, on account of a large tumour occupying the middle and lower part of the right thigh. The previous history of the case is contained in the subjoined extract of a letter from Dr. Meikle:—"I attended Miss L. S. and two of her sisters, in September 1861, during a mild attack of fever. She rapidly recovered, and did not again come under my observation till April last, when I was requested to examine her right thigh. The lower third of the femur was considerably enlarged, and the soft parts surrounding it were firm, and closely matted together. The circumference of the affected portion of bone seemed bulged out in all directions, and enlarged veins were seen ramifying on the surface of the tumour. The condyles of the femur were not involved in the disease, and the portion of the shaft above the tumour was of normal size. I was told that Miss S. had felt more or less uneasiness in the part since the date of the febrile attack. But she could trace it to no cause, having sustained no accident. The pain at this time was very moderate, being more, indeed, a sense of uneasiness than anything else, but it was increased during the night. Measurements were taken from time to time, which showed that the tumour at first was increasing in size, but not quickly, until July last, when, after exposure to cold in an open conveyance, she was seized with pleuritis, which reduced her strength very much. From this date the tumour made rapid progress, and it became evident that nothing but amputation would save the girl, for which purpose she was put under your charge. When I first saw her, her face had a somewhat dingy appearance, and it gradually became darker, until it assumed a leaden hue."

Symptoms on Admission. Patient is pale, emaciated, and presents a very cachectic appearance; pulse rapid and irritable; chest and urine found normal on examination; no glandular enlargement; tongue slightly furred. The whole circumference of the middle and lower part of the right thigh is occupied by a large tumour, over which the veins are greatly distended. The surface of the tumour is irregular, and there is at points an indistinct feeling of fluctuation. There is no œdema of the leg, nor glandular enlargement in the groin.

15th July.—To-day Mr. Spence performed amputation at the hip-joint in the following manner:—The patient having been put under chloroform, the abdominal tourniquet was applied over the aorta. The breech was brought well over the edge of the table, and the pelvis held steady by an assistant. The tourniquet was entrusted to Dr. Gillespie, while Dr. Watson compressed the femoral artery at the brim of the pelvis. Mr. Spence having abducted, and slightly flexed the limb on the pelvis, gave it in charge to Dr. Struthers. Then grasping the soft parts with his left hand, Mr. Spence entered the point of the knife in front of the tuberosity of the ischium, and

passing it obliquely upwards, in front of the articulation, brought out the blade almost midway between the anterior superior spine of the ilium and trochanter major, so as to form a large anterior flap, disarticulated the limb, and terminated by cutting a posterior flap nearly equal in size to the anterior. A large sponge was immediately applied to the posterior flap, until the large vessels in the anterior flap were secured. No artery jetted so long as the tourniquet was retained. After the arteries had been tied, and the tourniquet removed, the femoral vein continuing to bleed, a ligature was placed upon it. The flaps were then stitched together, and a pad placed on the anterior and posterior surfaces to keep them in apposition. The patient having been removed to bed, a beef-tea and brandy enema was immediately administered, and after she had rallied an opiate was given.

16th July.—Slept well ; pulse 130 ; no reactionary hæmorrhage since the operation.

17th.—Pulse 128 ; patient progressing favourably.

18th. Pulse 120.

19th.—Pulse 116 ; some of the stitches removed, and straps of plaster applied ; has been taking beef-tea, wine, milk, and a little brandy for diet.

20th.—Pulse 106 : stump looking well ; no dressing on the wound except a narrow strip of lint along the line of incision, and a pillow to support the hip.

21st.—Pulse 116 ; wound dressed with chloride-of-soda lotion.

22d.—Pulse 110 ; some more stitches removed to-day.

23d.—Pulse 106 ; the remaining stitches were removed, and straps applied.

24th.—Pulse 98 ; patient is taking tincture of the muriate of iron, nourishing diet, and wine.

25th.—Pulse 102.

26th.—Pulse 100 ; two ligatures came away to-day.

28th.—Stump looking well ; appetite good ; general appearance of patient very much improved.

29th.—Pulse 100 ; tongue cleaning.

30th.—Pulse 100.

31st.—Pulse 96.

1st August.—Pulse 90.

2d.—Pulse 86.

3d.—Pulse 90.

12th.—Pulse 86 ; femoral ligature came away to-day ; stump almost entirely healed up. During the last fortnight she has been walking about the ward, and has been out several times for a drive.

13th September.—Since last report recovery has gone on in a most favourable manner. Not an occurrence worthy of notice has interrupted the convalescence, and to-day she returned to the country in a state of health bordering on that of former years.

Remarks.—The mortality which attends amputation at the hip-joint, and which has even led some to question the justifiableness of the operation, is undoubtedly very great ; and hence considerable interest attaches to every successful case, the circumstances under which it was performed, and all the conditions which may have a bearing upon the general question of the operation in similar cases. According to the latest statistics of the operation, given in the recent edition of Cooper's *Surgical Dictionary*, we find that, in a total of 139 cases, there were 91 fatal results, or a mortality of 65·46. Moreover, when we know that in several of the successful cases the operation was performed on limbs

which had previously undergone partial amputation, and where, consequently, the shock and disturbance of the system caused by the sudden removal of the whole lower extremity were wanting, or at least greatly diminished, it seems evident that the risks of this formidable operation are such as must limit its performance to cases of extreme necessity.

In cases of certain severe injuries the surgeon may be forced to perform it as the only chance of saving, or at least prolonging life, and alleviating suffering by removing the shattered limb. In cases of disease, the question of operation comes before us under a somewhat different aspect, for the amputation may prove more speedily fatal than the disease would have done if left to its own course. Hence, to warrant its performance, the disease must be of a kind that admits no other remedy, and at a stage when the whole of the appreciable disease can be removed, and with a reasonable hope of prolonging life. In the case which forms the subject of the present remarks, we have a good example of the conditions which warrant us in having recourse to amputation at the hip-joint. The girl was suffering from intense pain, her appetite was almost gone, and her strength exhausted by the pain and want of sleep; her pulse was quick and irritable, whilst the tumour was increasing rapidly. The urgency of these symptoms showed the necessity of operative interference, if any attempt was to be made to relieve her sufferings and to prolong life, even for a short time; whilst the absence of glandular enlargement, either in the groin or elsewhere, gave hopes that the lymphatic system was as yet unaffected, and that, with youth on her side, there was a reasonable hope of success attending the operation. On the other hand, if it were delayed, or not performed, a speedy and painful death was certain.

The disease was limited as far as malignant disease can be said to be limited in the living body, where the circulation of the fluids prevents positive limitation to any special part. But practically, surgeons are agreed, from experience, that malignant disease, especially its medullary form, when situated in an anatomically limited organ—as the testicle, for example, where it is invested by a dense resisting capsule—admits of more thorough removal than when it occurs amongst muscles or other soft textures, whose structure it speedily involves in the same diseased action, without any definition or limitation. In the present case the disease had evidently commenced in the interior of, and was still apparently confined to, the shaft of the femur. Thus walled in, as it were, by the dense fibrous shell of the bone, or by the strong fibrous periosteum investing the shaft on every side, and closed in at either extremity of the bone by the articular cartilage of incrustation, the disease presented the utmost possible degree of anatomical limitation, and thus the best possible chance of complete removal. But to profit fully by this limitation of the disease, it was evidently necessary to amputate in the contiguity, and not through the continuity of the affected bone—a rule which I consider of paramount importance in such cases. Hence the reason why I considered amputation through the trochanters inadmissible, although the bone seemed unaffected; for, in many cases where no perceptible alteration in the form of the bone can be detected,

the disease will be found to be infiltrated into the cancellated texture, even of the neck and head of the bone; and there need be the less hesitation on this point, as I believe that, in cases of malignant tumours of the femur, amputation through the trochanters is attended with quite as much danger to life as amputation at the hip-joint.

I would here refer to the necessity which arose for applying a ligature to the femoral vein. The hæmorrhage from this vein continued after all pressure had been removed from the groin and abdomen, and as temporary pressure of its orifice, and other means failed to arrest it, and as it returned whenever the pressure was removed, I found it absolutely necessary to tie it. I have frequently seen troublesome bleeding from the femoral vein in amputation of the thigh, but in general it stops when compression is made by applying the flap against the cut surface, when all pressure above is removed, and the stump elevated; but here these means proved ineffectual, or perhaps, I should rather say the weak condition of the patient rendered it necessary at once to check all loss of blood. I confess that my prejudices against tying veins are very strong, and this step in the operation made me uneasy as to its effects; but, as the history of the progress of the case shows, my fears were groundless, not a single bad symptom having followed ligature of the vein.

In conclusion, the uninterrupted progress of the patient's recovery was most satisfactory. It is not often that even a simple amputation of the thigh goes on so well; and whatever may be the estimate of the operation in general, or whatever may be the chances of the disease returning in some other organ hereafter, it has, for the present at least, snatched the patient from the brink of the grave, and restored her to her family, and to the enjoyment of perfect health.

AMPUTATION AT THE HIP-JOINT.

M. W., aged 5 years, was admitted on May 29, 1865, into the Royal Infirmary, suffering from a tumour of the right thigh.

History.—Patient's mother states that about six months previous to admission the child complained occasionally of wandering pains in the right thigh, for which fomentations were applied. About three months previous to admission, however, the mother observed the patient walking as if her right knee was stiff; she had a considerable amount of pain in the limb; was sometimes fretful and low-spirited, but her general health was good. On being asked where she had pain, the patient referred it to various parts of the thigh; and on examining locally, the mother observed an oval lump on the outside of the lower part of the thigh, about the size of a "blackbird's egg," and said to be deeply seated. No increase of growth was observed, however, till about ten weeks before admission, when the child is said to have received a blow on the lower part of the thigh (with a chair), and since that time the tumour has been increasing rapidly. Since then, the patient has also complained greatly of pains in the limb, on account of which the part has been fomented, poulticed, and leeches, without any relief. The parents then consulted Dr. Thomson of Yetholm, who, recognising the nature of the case, prevailed upon them to send her to the Infirmary. During the last few days the patient has been losing her appetite, is low-spirited, and complains more of pains.

On admission into hospital.—Patient appears to be healthy, but is unusually quiet and reserved. Tongue slightly furred; lungs, heart, and other organs, normal. A tumour, of oval form, $5\frac{1}{2}$ inches in length, and about the same in breadth, was found occupying the anterior, outer, and posterior surfaces of the middle and lower part of the femur, just above the condyles. It is of firm consistence throughout, and moves along with the femur. The superficial veins are enlarged, but the skin is not adherent. Patient does not complain of pain on pressing the tumour. The inguinal glands on both sides, as also the right cervical glands, are hard, and somewhat enlarged.

1st June.—P. 86. Sleeps well, and is much better in health. Ordered alterative medicine, followed by tincture of the muriate of iron and cod-liver oil, twice daily.

6th.—P. 96. Has had more darting pains in the limb. General health continues good. Tumour not perceptibly larger since admission of patient into hospital.

7th.—P. 80. Slept well. Chloroform having been administered, Professor Spence made an exploratory incision into the swelling, and discovered it to be a tumour, as diagnosed. The patient's pelvis was then brought well over the edge of the table, and held firmly by an assistant. Professor Spence next, grasping the soft parts with his left hand, entered the point of the knife at the front of the ischial tuberosity, and passing it obliquely upwards in front of the articulation, brought it out almost midway between the anterior superior iliac spine and the trochanter major, so as to form a large anterior flap. Having opened the joint by this first incision, while Dr. Gillespie abducted the limb, the disarticulation was effected, and a posterior flap nearly equal in size to the anterior one was cut from within outwards. Immediately thereafter a sponge was applied over the posterior flap; Dr. Watson compressed the vessels over the brim of the pelvis. The vessels, including the femoral vein, were then ligatured, the flaps stitched together, pads placed over the anterior and posterior surfaces, and bandaged. When the effects of the chloroform had passed off an opiate was given, but the patient continued very restless, requiring to be held down for some time. No reactionary hæmorrhage took place.

On examining the limb the tumour was found to be of a grayish colour, of firm consistence, and of a medullary character. Microscopic examination of the adductor muscles of the thigh showed the nuclei of the muscular fibres to be greatly increased in number, and seemingly about to undergo cancerous degeneration. The fibres of the gluteus muscle showed fatty degeneration, but no proliferous cells.

6.30 P.M.—P. 80. Patient has been sleeping continuously for some hours, is very thirsty, and restless at intervals, and vomits on trying to take food.

9 P.M.—P. 100. Urine drawn off with a catheter. Opiate given as vomiting continued.

8th.—P. 100. Spent a very good night. Urine drawn off with a catheter.

4.30 P.M.—Patient has been sinking gradually, and is now unconscious. Pulse not perceptible; respiration rapid and very weak; has slight bronchitis; eyelids partially closed, and eyes oscillating. Ordered Spt. ammon. arom. in five drop doses, every five minutes; also an enema of beef-tea and wine, and a mustard-poultice to the chest.

6.30 P.M.—Still continues in a very weak state. P. 156, and very weak; respirations 60 per minute; has had her bowels opened freely. Beef-tea injections given every hour, and sal-volatile at intervals.

11 P.M.—Under this treatment patient rallied gradually; but as the nervous symptoms continued, fifteen drops of sol. mur. morph. were added to

the beef-tea injections. P. 140; respirations 40 per minute, and regular; has grinding of the teeth, twitchings of the face, with knitting of the brows, and gives occasional starting and delirious exclamations.

1.30 P.M.—P. 150, weak. Cerebral symptoms and general weakness somewhat increased.

9th, 10 A.M.—Has slept well during the night, and cerebral symptoms are absent. P. 140, weak; takes no food, and is supported by enemata; respiration regular and not laboured.

4 P.M.—Continues in much the same condition; has occasional grinding of the teeth and startings of the limbs. P. 112. Supported by enemata.

10 P.M.—P. 130, and weak. Same treatment continued.

12.30.—P. 140, and weak. Consciousness returned, and patient is inclined to sleep; cough somewhat increased, and pain in the abdomen complained of. Ordered a large poultice over the chest and abdomen; takes some food.

10th, 4 A.M.—P. 120. Has been sleeping calmly, but is beginning to start somewhat, and grinds her teeth slightly.

8 A.M.—P. 104. Very weak; is unconscious; grinds her teeth; lies with her eyes wide open, and complains of great tenderness in abdomen. Enemata continued, and poultices on abdomen.

10 A.M.—P. 116. Drinks milk heartily; stump dressed and looking healthy.

12 M.—P. 120. Weak; some of the old symptoms returned. Enema given. From this time forward patient gradually recovered. None of the cerebral symptoms returned, and appetite gradually improved.

11th.—P. 100. Is in good spirits; slight erythema along the edge of the wound. Some stitches removed. Discharge somewhat increased.

12th.—P. 108. Patient continues to do well. This morning she took a hearty breakfast of porridge and milk, in addition to tea, toast, and eggs. The stump looks very well; there is not much discharge, and it is of a healthy character. As the cough is troublesome she is ordered to-day the following mixture:—℞ Ammon. sesquicarb. grs. xxiv.; tinc. scillae, ℥ii.; decocti Senegae, ad ℥vi.; sig. a teaspoonful every three hours.

13th.—P. 104, of good strength. During the night she slept well, but was observed to start occasionally. Plasters applied to stump and stitches removed. Dressed with soda lotion.

15th.—P. 90: bowels regular; appetite good.

17th.—All the ligatures except one have separated. General health continues to improve. At the inner angle of the stump is a hard, red, and painful swelling, evidently an abscess commencing to form; for this fomentations were applied. P. 110.

21st.—P. varied from 104 to 120 during the night. Stump looking very well. Sleeps soundly. Appetite good.

23d.—P. 104. Yesterday, passed four, and to-day eighteen ascarides lumbricoides, of which some were very large. Ordered a purgative, followed by ℞ Santonin, gr. viii.; sacchar. ℥i.; M., et divide in pulv. iv.; sig. one to be taken night and morning.

25th.—Passed two more worms of the same kind, but smaller. Appetite has fallen off somewhat. The abscess in the groin burst to-day at the outer angle of the stump.

July 3d.—Since last report convalescence has been uninterrupted. To-day passed another small worm, which was the last.

From this date onward the patient improved daily. Appetite returned by degrees. The femoral ligature was withdrawn on July 6th, and the

incision healed up without the slightest bad sign, and remains quite sound at the present date.

Whilst it is generally admitted that the true principle in regard to amputation for malignant tumours of bone is to amputate beyond the bone affected, yet, in the case of the femur the dread of the immediate risks of amputation at the hip-joint has led practically to the abandonment of the principle, and amputation through or near the trochanters, in cases of malignant tumour, is often advised, and resorted to, as being safer than disarticulation, unless the growth is so high up as nearly to involve the trochanter. I think this a very serious error, as I believe in such tumours the disease permeates the whole of the medullary and cancellated texture of the femur, and that there is no security for the removal of the disease except in removal of the entire bone by disarticulation; and from what I have seen of high amputations in the thigh, for malignant tumours, I believe the risks of amputation through or near the trochanters to be as great, if not greater, than those of amputation at the joint. In the latter, the rapidity of performance is greater, the loss of blood less; whilst the risks of pyæmia are certainly less in cases of disarticulation than in amputation through the continuity of a bone, where we have the chances of myelitis, inflammation of the veins of the medullary Haversian canals, and acute necrosis, which are especially liable to occur in the state of the system accompanying malignant disease.

Besides the interest which attaches to a successful case of amputation at the hip-joint, that just recorded possesses interest in regard to the diagnosis of the disease, and the condition and treatment of the patient after the operation.

The general history of the disease from its commencement, the obscure wandering pains referred to the thigh long before any alteration in the limb was detected, and then the appearance of a small but distinct lateral swelling, as described by her mother, together with the subsequent rapid growth and increased pain, were all very characteristic of malignant disease of the femur. On the other hand, however, there was not the slightest appearance of the peculiar cachectic state which so generally accompanies malignant growths; the child was of ruddy complexion, and plump, her appetite good, and all the functions natural, though she was restless and somewhat irritable at night. The mother, however, had with her another younger child, evidently affected with strumous swelling of the periosteum, bones, and glands. At the time of the patient's admission into hospital there was no lateral projecting swelling, simply an elongated ovoid swelling, or enlargement of the femur, from the condyles to near the trochanters. Under these circumstances the question arose—Might not these symptoms be caused by periostitis and subacute osteitis, and perhaps incipient necrosis? To my own mind, the absence of rigors or febrile symptoms at any time during the progress of the disease, the distinct lateral swelling noticed at first, and the peculiar ovoid form of the enlarged femur, seemed pretty conclusive as to its being a malignant tumour of the bone; but still, under the circumstances, before proceeding to such an extreme

measure as amputation at the hip-joint, I considered it right to resort to an exploratory incision, as recorded in the report. In many instances a free exploratory incision will at once satisfy the surgeon as to the true state of matters ; but here it had a tendency to mislead, for, owing to the cancerous deposit being situated partly within the medullary canal of the femur, and partly between the periosteum and the shaft of the bone, and easily separable, it resulted that when I introduced my finger into the incision, I felt the bone bare and loosely connected, with swollen periosteum, just as in a case of necrosis, so that I had to enlarge the incision considerably to judge of the true state of the swelling. I draw attention to this, because, unless I had been pretty well decided before as to the nature of the disease, the condition presented in this case, so different from the irregular softened mass mixed with osseous spiculæ, generally met with in malignant osseous tumours, might have led to a wrong diagnosis and most disastrous results.

The method of operating in this case was the same as that I adopted in the case of L. S., previously recorded, and I think it the best in such cases where we have the power of choosing our procedure. Amputation at the hip can be readily performed by cutting one very large anterior flap, and disarticulating and dividing the posterior parts almost directly backwards ; but, as examination shows that even at an early period the muscles near the diseased bone are liable to be affected, it is of vital importance to plan our operations to avoid proximity to the tumour, so as to diminish the risk of retaining any morbid tissue in the flaps. Hence I prefer two shorter flaps to one very long one, as it must encroach more on the diseased parts by its greater length. In this, as in other successful cases I have recorded, the femoral vein was tied to arrest bleeding, and I believe, as I have stated elsewhere, that instead of being hurtful it seems rather to do good, by preventing pus or unhealthy discharge entering the venous circulation by the large open mouth of the vein, kept patent as it is by its fascial connections.

The progress of the case, as given in the report, shows how much success in such operations depends on careful after-treatment, watchfulness of symptoms, and persistence in appropriate remedial measures, even when the condition of the patient seems very hopeless.

It will be noticed that the urgent unfavourable symptoms in this case did not supervene till about twenty-four hours after the operation, when the risk from primary shock and reactionary hæmorrhago had passed. The morning report on the 8th June was "Pulse 100 ; spent a very good night," and at my visit at noon the child presented no unfavourable symptom ; but shortly after 3 P.M. symptoms of restlessness, nausea, and a state approaching to collapse, as detailed in the report, set in suddenly, and at 4 P.M. she seemed to be rapidly sinking. I believe that, but for her being very carefully watched, and the prompt and continued use of external and internal stimuli, the little patient must have soon died.

The character of the symptoms was peculiar : there had not been the slightest amount of reactionary oozing from the stump, and the child had slept well after the operation. Yet the state must have been the

effect of the operation on the nervous system; although it is just possible that the tenderness of the abdomen, the grinding of the teeth, and convulsive startings, may have been due to the presence of so many large intestinal worms; for though the more severe symptoms passed off, and she gradually began to amend, yet her rapid and thorough convalescence dated from the time the worms disappeared under the use of the *santonine*.

To the preceding instances of successful amputation at the hip-joint, I subjoin the two following cases recently under my care in the Royal Infirmary.

I have now performed amputation at the hip-joint in eleven cases, either primary or for disease, with five recoveries.

CASE I.—*Morbus Coxæ; Excision; Amputation; Recovery.*



Fig. 156.

Thomas H., aged twenty, a clerk, was admitted into Ward XIII. on *Sept. 24th*, 1874. The history records a series of abscesses near the hip-joint on two different occasions; once, at the age of ten, when he had injured his hip by a fall; and again five years ago, when convalescing from relapsing fever. Last May he had an attack of hæmoptysis.

On admission he was seen to be a delicate, anæmic-looking young man, emaciated to the last degree, and suffering evidently from advanced *morbus coxarius*—a diagnosis which examination confirmed. He was ordered wine and a ferruginous tonic; the sinuses at the hip to be dressed with lotion of chlorinated soda, and extension apparatus to be applied. At first he seemed to improve rapidly, due no doubt to the altered regimen and rest; and after residence for five weeks in hospital he was so much better as to be deemed fit for operation. The joint was accordingly excised on *Oct. 29th*. For a time he did well, but the discharge was always free, and often fetid; his health, however, remained wonderfully good, notwithstanding the great strain. On *Nov. 17th* he had a slight attack of pleurisy, and on *Dec. 20th* examination with the probe showed a piece of dead bone yet to separate. About this time he began to complain of pain in the region of the liver, which was seen to be greatly enlarged, and was most probably affected with amyloid degeneration. For this, counter-irritation with tincture of iodine was applied every second day, and seemed to do some good. On *Jan. 28th* a small piece of bone, which was pressing on the cicatrix of the excision wound, was snipped off. But during all this time the discharge

the excision wound, was snipped off.

was very free, and the patient seemed to lose ground. This state of matters continued, and on *April 3d* half an inch of the upper end of the femur and some loose necrosed portions of bone were removed. After this the patient appeared to be sinking fast, and, as a last resource, amputation at the hip-joint was had recourse to.

April 13th.—Pulse 84; temperature 99°; urine still with a trace of albumen. To-day Prof. Spence amputated the limb at the hip-joint. The patient having been placed under chloroform, Esmarch's (flat) elastic band was applied tightly to the limb from the foot upwards, so as to extrude a blood from the part. An india-rubber band was next brought round the thigh, immediately below the pelvis, drawn tight, and secured by being again passed round the limb and tied. The flat roller was then removed. Mr. Annandale now compressed the femoral at the pelvic brim, while Prof. Spence transfixed the limb and cut the anterior flap by the usual method. This he gave in charge to Dr. Duncan. The posterior flap was next cut, so as to have for one of its margins the incision made on the 29th October last for the removal of the head of the femur. The femoral artery was immediately tied and the other arteries secured. A small projecting necrosed portion of the acetabulum was then removed with bone-pliers, and the surface of the flaps, especially where the remains of sinuses were observable, washed with a solution of chloride of zinc (twenty grains to an ounce of water). The flaps were then brought together along the margins by silver wire sutures, the extremities being left free for drainage. A pad of lint was laid along each edge of the wound, a fold of boracic lint over its surface, and the whole secured with a broad flannel bandage around the pelvis.

Though the patient lost little blood, yet towards the end of the operation his pulse became very weak. On this indication ether was substituted for chloroform as an anæsthetic, and an enema of brandy and water given, which had the effect of strengthening the pulse. The enema was repeated on the patient being put in bed, and champagne and brandy and water ordered in frequent small doses.

14th.—Morning: pulse 110; temperature 100°. Evening: pulse 112; temperature 100°. Slept a little through the night, and does not complain of much pain. Takes beef-tea and milk.

15th.—Morning: pulse 118; temperature 101·6°. Evening: pulse 112; temperature 99°. Urine of sp. gr. 1012, with a trace of albumen.

19th.—Pulse has never been above 120, nor temperature above 99·6°, since the 15th inst. The stump looks well; a part towards the inner aspect has healed by first intention, and the discharge is decreasing. Patient is looking and feeling better than before the operation; sleeps well now, and takes his food. The urine still contains a trace of albumen.

30th.—Patient improving in every way. Temperature has been normal since the 19th instant, and continues so. Appetite good. The wound has healed with the exception of a small point in the centre of the incision, through which some discharge comes, and that part of the posterior flap which was formed of a previous incision. The latter, however, is healing well by granulation. Urine yet contains a trace of albumen, and liver dulness remains much as before.

May 27th.—Stump looking better, and patient much stronger. Urine slightly albuminous. Sent to Convalescent House.

Oct. 8th.—Patient's health since his discharge has continued good. Wound is now healed.

CASE II.—*Chronic Necrosis of Femur; Amputation through Hip-Joint; Recovery.*

Lilian S., aged nine, was admitted to Ward XV. on 10th July 1874, suffering from necrosis of femur and fibula. On admission the leg was found flexed on the thigh from the contraction of the hamstring tendons, and the signs of extensive necrosis of the femur were abundantly observable. Patient remained in the ward until 20th January 1875, when she was dismissed to the Convalescent House. During this time several pieces of dead bone were removed—one a sequestrum three inches long—and the wounds were dressed with chlorinated soda or dilute carbolic lotion, the patient meanwhile taking internally small doses of steel drops and dilute phosphoric acid. On 17th February she returned from the Convalescent House, and had the hamstring muscles divided, so as to straighten the limb. Dismissed again on 4th March, and admitted once more on July 26th with the thigh in a state much as formerly. Examination with the gunshot probe showed a large amount of



dead bone still to separate. The necrosis, besides being extensive along the shaft of the femur, implicated the great trochanter. Amputation at the hip-joint was accordingly determined on as a last resource; for the general health, although never very good, had lately been failing.

Aug. 3d.—The limb was amputated at the hip-joint by anterior and posterior flaps. The femoral and profunda were secured with silk ligatures.

Since the operation patient has never had a bad symptom. The ligatures came away on the 17th August without any hæmorrhage.

Oct. 1st.—Patient is now able to walk about on crutches, and is in health much better than before the operation.

Dec. 1875.—The girl's health is now quite restored.

PRIMARY AND SECONDARY AMPUTATIONS FOR INJURY.

I have selected the following as examples of the class of cases requiring amputation in consequence of injury, and as illustrative of what I have said in reference to the conditions which influence the mortality of primary amputation :—

SEVERE INJURY OF THE RIGHT UPPER EXTREMITY BY MACHINERY ; AMPUTATION OF THE SHOULDER-JOINT ; RECOVERY.

¹ CASE I. On the morning of the 9th December 1847, James Watt, millwright at a large paper-mill in the vicinity of Edinburgh, when inspecting the machinery, perceived that a part of it was loose. While engaged in fastening the loose part, the sleeve of his jacket was caught, and the right arm dragged between two wheels, and rapidly crushed. Notwithstanding the fearful nature of the accident, he possessed sufficient presence of mind, on feeling himself drawn forwards, to take off his cap with his left hand, and place it in a position to check in some measure the revolution of the wheels, and at the same time he directed those about him to cut the sleeve of his coat, telling them that the arm was already torn through. He was extricated just in time to prevent the body being drawn in, but not before the soft parts on the right side of the chest had suffered severely. The accident happened about half-past four A.M., and I saw him at half-past seven A.M.

I found Mr. Falconer and Dr. Thomson in attendance. The patient was lying in bed, pale and exhausted, having lost a considerable quantity of blood ; but, though suffering great agony, he was quite sensible ; the fragments of his clothes which had been left by the machinery had been removed, some stimuli had been administered, and external warmth applied ; his pulse was about 120, and the skin was covered with cold sweat. The injured arm presented a frightful appearance ; the limb was completely detached from about three inches above the elbow, and the humerus was again broken through obliquely, immediately below the insertion of the deltoid, leaving the attachment of that muscle entire ; but on the inner side the fracture had splintered the bone up to within an inch of the joint ; the middle part of the humerus, together with the soft parts, were hanging in shreds. On the right side of the chest the integuments had been entirely removed to within two inches of the sternum ; the clavicular and sternal portions of the pectoralis major had been completely torn off, so as to expose the pectoralis minor, the intercostal spaces, and externally the fascia covering the axillary vessels and nerves. The fragment of the humerus was drawn upwards and outwards by the deltoid, and the lower fibres of the great pectoral, which were entire, were tightly stretched across the lower border of the large wound, and gave it the appearance of a deep dissection. Although, from the nature of the injury, and the state of the patient, I had almost no hopes of his recovery, I thought it right to give him the only chance—viz. by amputation at the shoulder-joint.

A small quantity of spirits and water having been given, chloroform was then administered. About a drachm was poured upon some lint and applied to his nostrils by Dr. Thomson. He inhaled it readily, and scarcely a minute had elapsed ere it took effect : the fibres of the exposed muscles were first seen in violent action, and the face became suffused, the breathing became

¹ This was the first great operation in which I used chloroform.

stertorous, the fibres of the muscles assumed a slight tremulous motion, and then became perfectly still; his pulse fell in frequency, but was firm; the full effect of the chloroform was obtained in three minutes.

Mr. Falconer compressing the axillary artery between his fingers, above the lesser pectoral, I proceeded to amputate by forming my flap from the outer and back part of the shoulder, where the integument and muscles appeared sound, saving as much skin as possible. From the short lever remaining, I had anticipated considerable difficulty in disarticulating the head of the humerus; but in this I was agreeably disappointed, for, owing to the complete relaxation of the muscles induced by the chloroform, I was enabled to disarticulate it rapidly and with the most perfect ease. The insertion of the lower fibres of the great pectoral, and the other soft parts on the inner side of the humerus were divided, and the fragment of the limb removed. The posterior circumflex and two other vessels were tied, and next the axillary at the point where my incision had divided it: perceiving, however, that this point was close to the origin of some large branches, and fearing, moreover, lest it might have suffered from the injury, I had bare the vessel higher up, beneath the lower margin of the pectoralis minor, and tied it there also; after removing carefully all doubtful looking portions of muscle and skin, the flap was brought forward and found to cover the wound much better than I expected; it was secured by several points of suture, supported by compresses placed posteriorly at the lower part to prevent dragging, some warm-water dressing was placed over the surface anteriorly, and the whole secured by a split cloth bandage.

During the whole of the proceedings, which occupied about a quarter of an hour, the patient remained perfectly tranquil, and only became conscious after the dressing had been completed; a little wine and water were then given. He stated that he had felt no pain, and indeed knew nothing of the operation, but now felt much easier and revived; his pulse was at this time 68, and pretty firm. I left him in charge of Mr. Falconer, desiring that he should have an opiate draught. According to Mr. Falconer's report, the pulse gradually rose, and at three P.M. was 84 in the minute. There was considerable thirst, and he complained of darting pain in the wound, also of slight nausea, which, however, soon left him. In the evening he was less thirsty; the pulse continued the same, and he passed about six ounces of urine. Had a draught of thirty drops of solution of morphia at midnight.

At four A.M. on the 10th, his pulse was slightly accelerated and harder; he had slumbered occasionally for about half-an-hour at a time, but woke with pain in the wound; the skin was warm and moist, and after he had passed about six ounces of high-coloured urine, he fell asleep, and rested for some time; at noon he had a laxative draught.

On the morning of the 11th he continued pretty easy, having passed a good night, but as his medicine had not acted, he got a dose of castor-oil. His tongue was white and furred. Before 12 o'clock his bowels had acted twice freely, and his skin was moist and of a natural heat; he was allowed a little beef-tea. In the afternoon his pulse had risen to 100 in the minute, and was pretty full, though soft. The beef-tea was discontinued, and a little thin arrow-root allowed instead. In the evening he had passed water freely, and felt easy, but his pulse was still about 100, and the skin hot; had no headache. To have a draught of morphia and ipecacuan wine at bedtime.

12th. Seven A.M. Has passed a good night, pulse diminished in frequency and soft, skin of a moderate heat. 3 P.M.—Has suffered from sickness since morning. The wound was now dressed for the first time, and,

at his own request, chloroform was administered ; but after it began to affect him, vomiting took place, and Mr. Falconer desisted from its use. The wound was found of a favourable appearance ; suppuration had commenced at the lower part ; a little wine was administered previous to the dressing ; he felt much easier after its completion, when an opiate draught was given.

At 10 p.m. his pulse was 92, and soft ; he still felt sick, and had not slept since the dressing. To have a large opiate draught.

13th, Monday.—Passed a bad night ; suffered greatly from sickness and vomiting ; pulse 96, tongue covered with white fur, but red at tip and edges ; half a grain of solid opium was given him. At noon the bilious vomiting and sickness still continued ; pulse 100, countenance anxious. To have one grain of solid opium. At six p.m. he was much easier, the vomiting had ceased ; he had taken a little thin arrow-root and drank some tea. As he had no evacuation from the bowels since Saturday, an enema was ordered, and after it had acted a grain of opium was given at 10 p.m.

On the 14th I saw him, along with Mr. Falconer, and dressed the wound, which I found uniting at the upper part, and granulating at the other parts of the wound, the suppuration was of a healthy character ; he bore the dressing without much fatigue ; his pulse previous to the dressing was 86 and soft, the expression of his face and general appearance good. He had had no return of the nausea or vomiting, but his tongue was still somewhat furred, and he complained of thirst. For the purpose of allaying thirst and abating the irritability of the stomach, I sent him some citrated alkali for effervescing draughts.

On the 17th one of the ligatures came away, and on the 18th another, but without the slightest tendency to bleeding ; from this time he continued to go on favourably ; the wound healed rapidly, and no circumstance worthy of note took place, except a slight attack of bronchitis, which was promptly and actively treated, and he was able to leave his bed on the 1st of January 1848, for a short time, at which period a great part of the wound had cicatrised. On the 8th of January the ligature from the upper part of the axillary artery separated (this ligature had been marked at the time of the operation by a double knot on its free extremity ; the ligature from the lower part of the vessel, where it had been divided in the amputation, came away on the 17th of December).

In the beginning of February the wound was completely healed, with the exception of one part about the circumference of a sixpence, where a ligature projected, this I took away some time afterwards, and then this remaining part also healed up rapidly.

Remarks.—This case affords an example of the great amount of injury from which the system may recover ; and the results of this and similar cases warrant us in entertaining hope, and having recourse to operative measures, even in the most aggravated cases. Few examples of injury could have presented a more frightful appearance, or less likelihood of a favourable result, not so much from the shattered state of the arm and the quantity of blood he had lost, as on account of the extent of the laceration of the soft parts covering the chest, one side being almost denuded of its cutaneous and muscular coverings, and the patient lying cold, pallid, and collapsed, from the effects of the severe suffering he had undergone.

From the state in which I found him, I have little doubt that, had he been removed even a short distance to obtain surgical aid, the result

would probably have been very different. Indeed, from what I have seen of primary amputations, I believe that the very different results of such amputations in civil hospitals and military practice, and the comparatively greater success which will be found in private practice over hospital cases, is owing in a great measure to the fact, that in military and private civil practice the operation is performed either on the spot or at a short distance only from where the accident occurred, so that the patient undergoes but one shock; whereas a majority of the cases presented to the surgeon in hospital practice are often brought from a considerable distance, not in the easiest or most eligible conveyances,—and thus the patient, just recovering from the first effects of severe injury, is subjected to a second shock, or rather series of shocks, from the jolting of the shattered limb, before undergoing amputation; a condition which, in itself, apart from other considerations as regards the effects of hospital air, etc., is evidently less favourable than that of the patient to whom surgical assistance has been afforded without his having undergone a rough and exhausting journey.

There is another point to which I would direct attention, as I consider it of some importance to the prevention of secondary hæmorrhage, in cases where there is extensive injury of the soft parts around the vessels. In severe accidents from direct violence by machinery, the parts even beyond the apparent injury often suffer indirectly, their vitality is impaired above the points of amputation, and extensive supuration or separation of small sloughs takes place around the vessels or the vitality of the arterial tissue itself may have been so impaired by the traction and twisting, that separation of the ligature will probably take place, and secondary hæmorrhage occur, at a period before the canal of the artery has been obliterated. It was to avoid such a risk in this case that, besides tying the axillary at the point divided by the knife in amputating, I laid it bare and tied it higher up; and the result, I think, shows the propriety of the practice, for the lower ligature came away in eight days, so that, except for the ligature higher up, secondary bleeding would likely have occurred at that time. The case has also this interest, that it was the first great operation in which I used chloroform, which had just been proposed, instead of ether.

INJURY BY MACHINERY—DEATH FROM SECONDARY HÆMORRHAGE.

CASE II.—In October 1852 I was sent for by Dr. Ellison of Penicuik, to see a young man who had received a severe injury of the right arm by machinery in a paper-mill. I found the soft parts of the arm from near the shoulder, and down the forearm, extensively lacerated, the muscles in the upper arm being fairly stripped off the humerus, a portion of the inner side, comprising the great vessels, having alone escaped. The bones were not fractured, but from the nature and extent of the injury, and the complete destruction of the muscles and skin, it was evident that amputation at the shoulder-joint was the only chance for the patient.

This I did by lateral flaps, disarticulating and then forming the inner flap by cutting outwards. Whilst I was cutting outwards through the nerves and vessels, the patient, having partially recovered from the chloroform, made a

sudden movement, which threw off the hold of the gentleman who was compressing the subclavian artery, and a gush of blood from the axillary blinded me ; but luckily I succeeded in grasping the vessels and nerves, and secured the whole mass temporarily, till I had tied the smaller vessels ; then I cleared the axillary higher up, and placed a ligature upon it, removed the temporary ligature, closed the flaps by suture, and dressed the stump.

Next day I found the patient going on favourably : there had been slight venous oozing, which was arrested by cold water cloths, and there was now neither oozing nor tension of the stump. On the fifth day the patient was going on exceedingly well ; a large part of the stump had healed by the first intention, though at the lower part there was a considerable discharge of pus along the course of the ligatures, and a little erysipelatous redness.

Late at night, on the sixth day after the operation, I was sent for, on account of the sudden occurrence of hæmorrhage, but before I reached his house the patient was dead.

On opening and examining the stump, the greater part was found solidly adherent, and even along the course of the vessels there appeared to be no great amount of sloughing or suppuration. The hæmorrhage was from the axillary, which presented an open mouth, as if cut with a knife, to the extent of about two-thirds of its circumference, the ligature being still attached to the remainder. I learned from Dr. Ellison that the patient had been exceedingly well all that day, and that Dr. E. had seen him shortly before the bleeding occurred. It came on either during, or shortly after, the patient had been turned in bed, and though Dr. E. succeeded in arresting it by pressure, so much blood had been previously lost, that he soon sank.

CASE III. — J. C. was admitted in a state of great prostration, due to a severely compound comminuted fracture of the humerus, with the limb almost severed from the trunk ; a dislocation of the right hip ; and a very severe wound of the dorsum of the foot. As the chief laceration of the tissues was on the inner surface of the arm, amputation was performed by a long antero-posterior flap cut from without. Died twelve hours after admission.

CASE IV. — John L., æt. 66. Compound comminuted fracture of the arm and forearm, the result of a railway injury. The patient had come from a distance and had lost a large quantity of blood. Amputation by a long external, and a short internal flap cut from without. He sank next day.

Remarks.—Primary amputation at the shoulder-joint is one of the most successful of the major operations. If a fatal result speedily follows its performance, as in the two last cases, it will be found to depend on unavoidable causes, such as the complex nature of the injuries, hæmorrhage, etc. One died from the severe shock arising from the crushed arm, the dislocated hip, and the lacerated foot ; the other, an old man, perished from the effects of the loss of a large quantity of blood previous to admission.

Secondary hæmorrhage, which occurred in the amputation at the shoulder (No. 11.), is by no means a common cause of death after primary amputations ; but as it has led to a fatal result in other cases of amputation at the shoulder-joint, it may be as well to examine into its probable causes in the case narrated.

The artery had been tied well up from the margin of the flap,

where all the tissues were apparently sound; there seemed to have been no want of healthy action in the stump, as the greater part had united, and there did not seem to have been any great amount of supuration even along the course of the vessel; yet the bleeding occurred at a very early period, and the vessel, little altered in appearance, seemed as if cut with a sharp instrument for about three-fourths of its circumference; in short, divided by acute ulceration, presenting no appearance of internal clot or external plastic effusion.

The nature of the injury, in this case, may probably account for the result, for the arterial tissue may have suffered from the dragging and twisting by the machinery, and thus had its vitality impaired to a much greater extent than would at first sight appear. When the injury necessitating amputation is direct, as a crush by machinery or the wheel of a carriage, the arterial tissue is not likely to be affected much beyond the parts injured; but when the limb has been dragged and twisted by machinery, as in this case, then, as I have said, the effect of the traction may have injured it much higher, and hence the more rapid ulceration caused by the ligature. I suspect, also, from what I was told, that the patient, feeling pretty well, had not been so quiet as was desirable, and he was being moved when the hæmorrhage occurred.

DOUBLE PRIMARY AMPUTATION OF ARM.

T. A., æt. 25. Both hands and lower part of forearms blown off by the explosion of gun-cotton in a quarry. Though patient was very weak and only partially conscious, Professor Spence amputated both arms as being patient's only chance. Patient lived for one hour after the operation.

SECONDARY AMPUTATION OF ARM.

G. G., æt. 17. While leading a horse by the bridle the animal seized the forearm with his teeth, and inflicted a compound comminuted fracture. He was under treatment for ten days previous to being sent to hospital. Conservative measures were tried, and a fortnight after admission several pieces of bone were removed. Under the prolonged discharge from the wound, and from the ulcers which had formed over the sharp prominences of the condyles, his general health became impaired. The inflammatory action extended towards the wrist, and in the fourth week supuration occurred within the joint. Under such circumstances there could be no hesitation in removing the limb. The operation was performed below the middle of the arm by a long external and short internal flap formed by transfixion. Recovered.

PRIMARY AMPUTATIONS OF THE THIGH AND LEG.

1. John Reilly. Compound fracture of tibia and fibula, communicating with knee-joint, the result of a railway carriage passing over his leg. Amputated at lower third of femur. Long anterior flap. Pyæmia set in, and patient died at the end of the fourth week.

2. Alexander R., whilst in a state of intoxication, fell under the wheels of a railway carriage, and sustained a compound comminuted fracture of both legs—in the one communicating with the knee-joint, whilst the other

limb was almost completely cut off below the knee. Amputation of both limbs performed at lower third of femur. Patient never rallied, and died on the third day.

3. Jessie Brown, was violently whirled round by machinery, and sustained a very severe compound fracture of thigh, together with laceration of perinæum. The limb was amputated very high up; but patient never rallied, and died on the following day.

4. R. B. Compound comminuted fracture of right leg and arm. A railway carriage had passed over the leg, crushing it to a complete pulp. This patient, having lost a large quantity of blood previously, was admitted in a state of complete collapse, from which stimulants freely administered failed to rouse him. As there was oozing of blood into the tissues of the leg, amputation by the long anterior flap was performed at the lower third of the thigh, as affording the only chance of life. Had the state of the patient admitted, the arm also would have required amputation. He lived twenty-six hours after the operation.

5. P. L. fell down a height of thirty-five feet, and was brought to hospital suffering from compound comminuted fracture of femur, communicating with knee-joint, and a similar fracture of both bones of leg. Amputation at middle of thigh. Cured.

6. J. M'C., æt. 33. Compound comminuted fracture of the leg communicating with the ankle-joint, resulting from a railway truck having passed over the limb. Amputation below the knee by long internal, lateral, and short external flaps, cut from without inwards. There was not the slightest tendency to the projection of the margin of the tibia; the recovery was rapid and complete.

7. C. C., æt. 73, was knocked down and run over by a loaded van. The chief injury sustained was a compound fracture of the leg, for which amputation below the knee was performed by the long posterior flap cut from without. She had been a habitual drunkard for years, and was intoxicated at the time she sustained the injury. The wound remained in a very inactive state, the discharge being thin and serous. She died on the sixteenth day after admission.

8. J. M., æt. 25. Compound comminuted fracture of leg and ankle, resulting from a railway waggon passing over the limb. Amputation by a long posterior flap. Recovered.

Commentary.—As regards the advantage of primary over secondary amputation in all cases where there is no reasonable hope of saving a useful limb, or where the risks to life seem too great to warrant any attempt to save the limb, I think there is now very little difference of opinion amongst practical surgeons; but in these days of conservative surgery, some few, looking at the admitted danger of primary amputations, such as those of thigh, seem to think that in almost all cases we should make the attempt, or at least delay,—for, say they, you may perhaps save the limb, and if not, you can always amputate later with perhaps a better chance of success. But this is assuming what is not the fact, for every surgeon who has had much experience in accidents knows that in cases of compound fracture, where legitimate attempts have been made to save the limb, the most general cause of a fatal result is pyæmia, not exhausting discharge, or even gangrene, which are comparatively rare; and, consequently, if we delayed in more

hopeless cases, we should probably never have the opportunity for the secondary operation to which they would have us trust.

I would merely refer to the fatal cases of amputation of the thigh, as showing the nature of the accidents requiring this operation as their only chance for life, and as exemplifying what I have said as to the causes which influence the mortality of the greater primary amputations.

First, we have the case of a poor girl caught by machinery ; her thigh crushed, the perinæum lacerated, and then brought into the hospital from a very considerable distance, the amputation requiring to be performed through the trochanters.

Next, we have the case of the man R., who had one leg torn off, and the other crushed and mutilated by a railway truck, who had lost much blood and lain exposed, no one could exactly say how long, but at least an hour and a half, in one of the coldest nights of a severe winter, and both of whose thighs required to be amputated immediately. Another fatal case, that of John Reilly, was one where the amount of injury was less than in either of the former, it being a compound fracture extending into the knee-joint, caused by a railway waggon passing over the leg ; this man was brought from a distance, and had lost some blood, though not, I believe, a large amount, before reaching the hospital. Although much depressed at first, he went on very favourably till the end of the third week, when symptoms of pyæmia set in rather suddenly and destroyed him. But here, as in all cases of railway accident, I suspect the general shock is much greater than it appears, and tells ultimately on the constitution. I have noticed that even the less severe compound fractures so caused, not unfrequently terminate fatally by pyæmia, after seeming to progress favourably for two or three weeks. A circumstance connected with this very case seems to show how severe the shock may be without any very extensive local injury. It happened that the young man who succeeded Reilly in his post at the railway met with a similar accident about eight days afterwards, and was also sent to be under my care. On admission he was pale and collapsed ; he had stimulants administered, and when I saw him, six hours after the accident, he had revived ; and as I found he had suffered a compound fracture into the knee-joint, I had him removed into the operating-room for the purpose of amputating the limb ; but as he was about to be lifted from the basket I observed his face very pale, and feeling the pulse, it had become so weak that I desired him to be left, and stimulants, and heat to the surface to be applied. I waited with him for above an hour, but he still continued in the same collapsed state. I then ordered the treatment to be kept up, and left him ; and, on returning two hours afterwards, I found he had just expired, without ever rallying. I, and all who saw him, concluded he must have received some injury of the pelvis, or rupture of some internal organ, or had internal hæmorrhage ; but the most careful post-mortem examination of the body revealed nothing beyond the local injury and the shock to account for death. From this and other instances I would infer, as I have already said, that in cases of injury by great direct force, as by railway, or machinery, and gunshot, such a shock may be caused as may affect the powers of life immediately, as in this case, or

more slowly and gradually leading to the form of pyæmia which proved fatal in Reilly.

The fourth case, that of R. B., is an example of a class which I have referred to in my Lectures, where the surgeon is obliged to amputate at once, notwithstanding the depressed state of the patient, in consequence of bleeding going on amongst the textures of the limb.

In the successful case we have an example of a much greater amount of injury to the bones of the limb, as there was a greatly comminuted fracture of the femur, communicating with the knee-joint, and fracture of the bones of the leg, but caused by indirect violence from a fall; and though much more advanced in life, and not of strong constitution, the patient suffered comparatively little constitutional disturbance after the operation, whilst, had it been delayed, I have no doubt the result would have been very different. The fatal case of amputation of the leg is scarcely a fair example of primary amputation, as nearly thirty hours had elapsed since the injury before the operation was performed, the patient having been sent from a very long distance to town, conditions very different from what we have in cases of amputation performed soon after the injury. At the time this case was under my care I operated in private on a female patient above sixty years of age, on account of compound fracture into the ankle-joint; she made an excellent recovery, but then the operation was done soon after the accident, and without removal of the patient.

PRIMARY AMPUTATION OF THIGH; DEATH FROM MORTIFICATION OF STUMP.—(*Cases referred to in Lecture LXXVI., pp. 684, 685.*)

1. David Wallace, æt. 25, admitted August 11, 1854, on account of compound comminuted fracture of the bones of the leg. A heavy truck passed over his right leg about two P.M. The gentleman who first saw him applied a tourniquet, and had him sent into the hospital in a cart. He arrived at six P.M. He was pale, and his pulse very weak from loss of blood. On examination the bones were found to be ground to pieces, just below the tuberosity of the tibia; the muscles of the calf were divided and mixed up with fragments of bone; the skin was entire, excepting on the front and on the outer side. Four oz. of brandy and ʒi. of solution of morphia were administered. He was put under chloroform, and removed to the operating theatre, but nearly sank on the way, respiration and pulse ceasing almost wholly. He was allowed to awaken, and had two oz. of whisky as soon as he could swallow; he was again put under chloroform, and amputation by flaps performed at the lower third of the thigh. During the operation he nearly sank. He was then removed to bed, and surrounded with hot bottles; two oz. whisky and ʒi. morphia were administered; in a short time he vomited; the morphia was repeated; pulse 120, very weak. He rallied about three next morning, under the assiduous application of stimulants and warmth. In the afternoon the skin was warm and moist; pallid hue gone. Ordered ʒi. sol. mur. morph., which he soon vomited; bismuth alb. gr. x. He became very excited and restless; the dressings came loose; dry lint was applied. Three stitches were removed, as some oozing had taken place. He slept well during the night, but awoke weak and restless; pulse 130. To have port wine ʒss. every hour, and sol. mur. morph. ʒi. and ʒi. xx. every fourth hour, if neces-

sary. The bowels were moved by enema. At five P.M. the pulse was 130, full. Slept soundly all afternoon. Sweated profusely, but felt quite comfortable. At seven P.M. he was found pale and collapsed, only semi-conscious. There was a fetid smell round the bed. There was a bluish line all around the stump above the dressings, and a row of phlyctenæ behind it; the bandage was becoming tight. All dressings and stitches were removed. The stump, as high as the trochanters, was quite cold and emphysematous. A poultice was immediately applied all over it. Wine $\mathfrak{z}\text{iv}$. and whisky $\mathfrak{z}\text{ij}$. were given; but the gangrene spread rapidly, and the patient died at half-past nine P.M.

No examination was allowed. Shortly after death the body became of a purplish hue, and emphysematous all over, especially the head and face.

2. Wm. G., æt. 30, was knocked down by a railway waggon, which passed over both his lower limbs. The right thigh was fractured in the lower third; the soft parts were considerably bruised, and there was enormous swelling, from extravasation of blood into the textures of the limb. The leg was cold; no pulsation could be felt in the tibial vessels. The left leg and thigh were likewise much bruised and slightly lacerated. Amputation was performed through the upper third of the right thigh, by anterior and posterior flaps. A portion of the muscle in the stump sloughed; the ulceration extended towards the femoral artery, and on the ninth day opened into that vessel a little above the ligature, which remained attached. On raising the stump and applying cold, the hæmorrhage ceased; but it recurred six hours thereafter. Mr. Spence then cleared the vessel from the surrounding tissues, and applied a ligature above the bleeding point. The sloughs separated; the wound looked healthy, and partial adhesion had taken place; but matter formed extensively in the left thigh and leg, and, under this profuse discharge the patient sank in the fourth week.

SECONDARY AMPUTATIONS OF THIGH FOR INJURY.

1. S. C., æt. 8, was admitted on the 15th of July with a compound fracture of the thigh between the middle and upper thirds, resulting from a fall into an area from a height of twenty feet. The wound in the integuments was very small; and the limb was placed in a long splint. Necrosis of a considerable portion of both the upper and lower fragments of the bone took place, and abscesses formed around the thigh, with profuse purulent discharge. As the patient was evidently sinking from hectic caused by the profuse discharge, while the necrosed portions of bone had not separated, amputation was performed on the 26th of August, immediately below the trochanters, by antero-posterior flaps formed by transfixion. The case promised well for some time, but pyæmia set in, and death occurred on the 18th of September.

2. C. A., a strong healthy girl, æt. 16, was admitted on the 13th of July with a compound comminuted fracture of the leg, caused by a butcher's light cart having passed over the limb. Pulsation in tibials distinct; temperature of the foot good; no great bruising of soft parts. Several detached portions of bone were removed, and the limb placed in a Liston's splint. July 17th. —Gangrene of the limb having taken place, amputation was performed at the lower third of the thigh, by the long anterior flap. There was unusually little bleeding during the operation, and there was no sloughing or gangrene of the stump; but the patient took a rigor on the 20th, and died of pyæmia on the 29th.

3. M. J., æt. 16, while running from a ram, tripped and fell: Her

right limb lay across a narrow drain, and against it the chief violence of the animal was directed. The butting against the knee was so severe as to separate the external condyle, and at the same time cause great distortion of the joint and extravasation of blood into the surrounding textures. At first the knee-joint was thought to be dislocated, and attempts were made to reduce it. She was sent into hospital next day. The limb was placed in a wire splint, and fomentations applied to the joint. For about three weeks the patient went on favourably, but the soft parts began to slough, and the joint was ultimately opened into. Therafter, acute synovitis set in, accompanied with irritative fever and profuse unhealthy discharge. In the beginning of the fifth week the symptoms assumed a hectic character. As the patient was evidently fast sinking, and as her only chance of life was amputation, the limb was removed by the modified circular method, through the middle of the thigh. She died a fortnight after the operation.

4. John B. A loaded waggon passed obliquely over his right thigh, fractured the external malleolus and astragalus, and caused great extravasation into the textures of the leg and foot. At first it was thought possible to save the limb, but by the following day it had become quite cold and perfectly numb. As it was impossible, under these circumstances, to amputate with safety below the knee, the operation was performed through the lower third of the thigh by the long anterior flap. Recovered.

Remarks.—The successful case, John B., may be considered rather as a deferred, than, properly speaking, a secondary amputation. The state of collapse in this patient rendered it doubtful whether the coldness of the injured limb might not depend upon the general depression of the circulation, rather than on the local lesions, and therefore I considered it prudent to wait until moderate reaction took place, before deciding as to the necessity for amputation.

STATISTICS of AMPUTATIONS and EXCISIONS¹ performed for Disease in Mr. Spence's Wards during the years 1860, 1861, and 1862, referred to at page 691 (footnote).

	No.	Recovered.	Died.
Hip-joint . . .	1	1	0
Through Thigh . .	25	23	2
Leg . . .	5	5	0
Ankle . . .	22	22	0
Shoulder (injury)	3	3	0
Carry forward	56	54	2

¹ These statistics for the years 1860, 1861, and 1862 were prepared by the late Mr. Macdougall, then treasurer and superintendent of the Infirmary, I believe for a Parliamentary return on the Sanitary Conditions of Hospitals. The comparative results in the wards of the three acting surgeons were tabulated, and a copy was sent to each. My copy is now before me. I subsequently verified the statistics in my own wards. The mortality in the primary amputations was in cases of amputation at the hip-joint, high amputations of the thigh, and amputations of the leg. Several of the fatal cases were double amputations, and the majority died within forty-eight hours after admission. Such primary cases are obviously of no value for comparison as to different methods of treatment.

	No.	Recovered.	Die
Brought forward	56	54	2
Arm (disease)	3	2	1
Forearm	4	4	0
Total	63	60	3

EXCISIONS.

Shoulder	1	1	0
Elbow	21	20	1
Knee	1	0	1
Total	23	21	2

STATISTICS of AMPUTATIONS treated ANTISEPTICALLY (1878-1882).

I. UPPER EXTREMITY.

(1.) Amputation at Arm.

A. INJURY—			
a. Primary	1	1	0
β. Secondary	5	4	1
B. DISEASE	1	1	0
Total	7	6	1

(2.) Amputation at Forearm.

A. INJURY—			
a. Primary	1	1	0
β. Secondary	0	0	0
B. DISEASE	0	0	0
Total			

II. LOWER EXTREMITY.

(1.) Amputation at Thigh.

A. INJURY—			
a. Primary	0	0	0
β. Secondary	1	0	1
B. DISEASE	8	6	2
Total	9	6	3

(2.) Amputation at Knee.

Total (Secondary)	1	0	1
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(3.) Amputation at Leg.

	No.	Recovered.	Died
A. INJURY	0	0	0
B. DISEASE	6	5	1

(4.) Amputation at Ankle.

A. INJURY	0	0
B. DISEASE	1	0

Total number treated
Antiseptically . 25 19

REGIONAL SURGERY.

INJURIES OF HEAD.

LECTURE LXXXI.

INJURIES OF THE HEAD—Anatomy of the Textures involved, viewed in its Normal and Pathological Aspects—Primary and Secondary Effects of Injuries—Wounds and Bruises of Scalp: their Varieties, Phenomena, Complications, and Treatment—Compression and Concussion of the Brain—Symptoms of Concussion: its General Treatment.

INJURIES OF THE HEAD.—Whilst each of the various forms of injury occurring in this region possesses its own peculiarities, their chief interest is derived from the effects they may induce, either primarily or secondarily, on the brain and its membranes: so that what appears at first a trifling injury may, unless carefully attended to, lead to a serious or even fatal result. Accordingly, in treating injuries of the head, we require constantly to keep in mind the nature of the textures injured, and their relation to the brain and its membranes.

INJURIES OF THE SCALP have dangers which depend both on the character of the scalp-texture, and on its vascular connections with the cranial bones and the dura mater. The scalp is composed of several tissues, closely connected. The skin is of close dense texture, and is united by slips of fibrous tissue to the occipito-frontalis, the broad tendinous or aponeurotic expansion of which forms a sort of central tendon to the anterior and posterior bellies of that muscle. The interstices between these fibrous connections are filled by a quantity of dense granular fat, and the tissues are largely supplied with blood-vessels and nerves. In the lateral region of the head, we find the strong temporal aponeurosis underlying the scalp. The deep surface of the scalp presents a smooth layer of dense fibro-cellular structure, which is very loosely connected by a quantity of fine cellular tissues with the pericranium. This cellular tissue is largely permeated by bloodvessels, which enter the bones and communicate in the diploë with branches which ramify in the dura mater.

The anatomical structure of the scalp—its dense unyielding texture, its great vascularity and nervous supply, the large amount of fibrous

and aponeurotic tissue which it contains, blended intimately with the more highly organised textures, together with the vital connections existing between it and the cranial bones and membranes of the brain, have important bearings in relation to diagnosis, prognosis, and treatment of injuries occurring in the region; and hence we always regard these, even when slight, as deserving of watchful attention.

Bruises of the scalp may prove troublesome, from the injury leading to inflammation and unhealthy suppuration, or being complicated by dangers arising from the force causing the bruise affecting the brain and its membranes, as in concussion.

The character of the swelling which follows extravasation from bruise of the scalp, deserves our attention in reference to diagnosis. If the deep surface of the scalp be ruptured and blood effused, such extravasation may and very often does spread over the whole extent of the head, causing enormous swelling on the cranium, bulging over the orbits, and posteriorly passing down towards the neck. This arises from the loose connection between the scalp and pericranium, permitting the blood to spread uninterruptedly. The appearance of the patient, in some cases, is frightful enough; but, as a general rule, if rest be enjoined, and cold evaporating lotions applied at once, the blood is rapidly absorbed, and no bad consequences may result: the laxity of the connecting tissue allowing of great distension without injurious pressure on the pericranium and bone. Incisions to evacuate the extravasated blood can hardly be requisite, except the tension be very great, and attended with constitutional symptoms. When speaking of contusions, I have already pointed out the dangers attendant on opening collections of effused blood, and in this region these dangers are aggravated by the close relation of the effusion to important parts. Should symptoms of inflammatory tension or of suppuration occur, then, of course, incisions are imperatively required; and there should be no delay in making them freely, to evacuate putrid blood and pus.

In some rare cases, where the extravasation arises from rupture of a large artery, such as the occipital or temporal, a pulsatory motion is communicated to the swelling, as in false aneurism. In such cases firm pressure applied over the trunk of the injured vessel, and cold lotions to the swelling will generally suffice to effect a cure, without having recourse to more heroic measures.

When the extravasation takes place into the scalp-texture, instead of beneath it, the extravasation is limited, owing to the density and close connections of the different tissues forming the scalp. This peculiarity of structure gives rise to a peculiarity in the swelling, which might lead—indeed often has led—to error in diagnosis. As the extravasated blood coagulates in the interstitial texture of the scalp, the flattened swelling assumes an extreme hardness; whilst towards its centre, where a portion of fluid blood or blood-serum exists, the swelling pits, and on pressure the finger feels as if it passed down through an opening or depression of the bone, and a depressed fracture is suspected. The diagnosis, however, is not in general difficult. If the finger be pressed firmly down, the fluid blood or serum is displaced, and the flat surface of the cranial bones is felt. The condition, how-

ever, when complicated with the existence of severe concussion or symptoms of compression, may prove perplexing, and even lead to unnecessarily active practice. When the real state of the case is ascertained, the extravasation requires very little treatment beyond perfect rest and the use of cold applications to the bruised part.

Wounds of the scalp, whether incised, punctured, or lacerated, are, from the nature of the texture wounded, more likely to be followed by erysipelatous inflammation than wounds in other parts of the body. At one time this risk was increased in consequence of the method of treatment adopted. A great dread existed of the bad effects of sutures and ligatures in scalp wounds, and so they were dressed with pads of lint, plaster, and bandages. This excited irritation and led to the very danger it was intended to obviate. A simple incised wound of the scalp will in general do well if treated on the same principles as any other incised wound. In all forms of scalp wounds the part should be shaved. Bleeding vessels must be secured, and as, in a dense texture like the scalp, the arteries cannot always be readily drawn out to be tied, acupressure has been long employed for this purpose, and the needle used, as in harelip suture, to unite the edges of the wound. If the wound be large, points of interrupted silver suture should be used, as giving rise to little irritation, and dry cold, by means of ice in india-rubber bags, may be applied with advantage for some time. This local treatment, combined with rest and attention to constitutional symptoms, will generally prevent the accession of erysipelas or other bad symptoms.

In punctured scalp wounds, where injury has been inflicted with some force—as for example when a person falls on a pike or a sharp-pointed stone, or when a sharp-pointed body projected with force strikes and perforates the scalp—we must be careful in our examination of the wound, as a punctured fracture of the bone (a most dangerous lesion) may be present, and would necessitate prompt and decided measures to avert bad consequences. Even in cases where there is only a punctured wound of the scalp, there is greater risk of erysipelatous inflammation or unhealthy suppuration following than in the incised wound. In such cases the proper treatment consists in applying dry cold to the part, enjoining a non-stimulating diet, and keeping the bowels freely open. Should inflammatory tension supervene, the punctured wound should be freely incised, with the view of at once relieving tension and depleting, and also of allowing any pus or putrefying blood to get free vent; poultices or warm water lint-dressing applied over the wound and neighbouring parts, until the acute stage has passed off, when gently stimulating lotions should be substituted. By adopting the treatment I have indicated we obviate the dangers arising from extension of erysipelas over the scalp, the lodgment of unhealthy pus and blood in the vicinity of the cranial bones, or of the important internal structures becoming affected by the continuity of vascular supply.

Lacerated scalp wounds are of very common occurrence, and unless carefully treated and watched may prove very serious. In many cases such wounds are very extensive, and present a most frightful and

ghastly appearance. It does not, however, follow that these very extensive wounds are always the most dangerous, and we require to consider the whole circumstances to form some estimate of the risk in each case. A reference to what has been already said of the anatomy of the scalp will explain the peculiarities of such wounds. The close connection of the different textures composing the scalp, and the resistant character of the aponeurotic structure which enters so largely into its composition, may account for the circumstance that we rarely find large portions of the scalp torn away, even when the parts are much lacerated, as by machinery; whilst the loose connection it has with the pericranium admits of it being readily detached from the subjacent structures, over a large surface, without such injury as would impair its vitality. This also explains why it fortunately happens that the pericranium is seldom detached to any great extent in such wounds. Thus we often see half of the scalp stripped from the cranium, and hanging over the face or side of the head, and yet wonderfully little constitutional disturbance follows, and the wound, if properly treated, heals kindly. The treatment of lacerated wounds of the scalp must be conducted on the general principles laid down when speaking of lacerated wounds, bearing in mind the peculiarities of structure and connection already alluded to. In most cases of this kind we find the torn and everted scalp covered with mud or dirt, as such injuries usually occur in consequence of persons falling from horseback and being dragged along the road, or from the head coming in contact with the wheel of a passing carriage or cart, or from the hair getting entangled in machinery. The injured scalp and cranial surface require to be cleansed from all foreign substances, and then the scalp should be carefully readjusted and maintained in position by points of silver wire suture. At one time this, as I have already said, was greatly objected to, as being likely to cause erysipelas; but it is less likely to cause irritation than heavy dressings of plasters, pads of lint, and complex bandages. The surgeon sees the progress of the wound, and can remove any sutures that seem irritable. Discharge is prevented from accumulating; a piece of lint soaked in tepid water or boracic lotion is merely laid over the part, and the patient is thus saved much pain and discomfort. Sutures I have used long before the introduction of silver wire sutures, and I never saw any irritation follow even when the ordinary silk was used; and though we do not expect such wounds to heal by the first intention, the sutures maintain the detached scalp in position until it gets "a set," if I may so speak. Whereas, if we do not employ stitches, the scalp falls away, contracts upon itself, and leaves a large gap; the edges of the wounded scalp become thick and everted; the healing process is very slow, and occasionally ulceration of the pericranium, with head symptoms, may arise in a scalp wound from neglect of accurate apposition at the first.

In cases where the scalp is contused and torn rather than detached, as in injuries inflicted with blunt weapons, the local treatment at first is the least important. Warm water lint-dressing should be applied to the wound at first, and simple or charcoal poultices afterwards, in suppuration or sloughing supervene. In such cases we require

to be specially on the watch for the development of head symptoms, especially those which indicate suppuration within the cranium. Erysipelas with smart fever and delirium may and often does occur without great danger. The most dangerous cases are those in which all seems to be going on favourably until about the eighth or tenth day, when the patient complains of not feeling so well; then a distinct rigor or repeated chills are felt, followed by headache and a low delirium; the edges of the wound become glazed and everted, or the scalp around has a puffy appearance, and the bone is seen bare. The delirium increases, and gradually the patient becomes comatose. In such cases there has probably been suppuration between the bone and dura mater, resulting from the continuity of vascular supply between that structure and the scalp. This result is liable to occur in all forms of scalp wound, and is one of the cases where the operation of trepan may be required to evacuate the pus; but of this I shall have to speak hereafter.

In cases where a contused or lacerated wound of the scalp is in the vicinity of or involves a large artery like the temporal or occipital, without actually wounding the vessel, if the wound takes on an unhealthy action secondary hæmorrhage may result from ulceration of vessel. As this may occur suddenly, we should secure the patient against the risk by placing an acupuncture needle below the artery at a healthy part, and this in no way interferes with the ordinary dressing of the wound.

In all cases of scalp wounds, when erysipelatous inflammation, attended with much tension, supervenes, incisions must be made into the swollen scalp, and warm fomentations, such as those of chamomile flowers and hops applied to the head. Abscesses in or under the scalp texture must be opened early and freely, and the constitutional symptoms watched, and met by appropriate treatment.

Before proceeding to speak of the injuries of the cranial bones, it is necessary to consider the effects produced by the shock of force communicated to the brain, or those produced by laceration or compression of its substance, as these effects on the contained organs constitute the important features in all forms of head injury.

There are two conditions, CONCUSSION and COMPRESSION, which we require specially to consider. These conditions are very different in their essential nature; but the symptoms on which our diagnosis must be founded are not always well defined, owing to the less serious condition being often complicated with other lesions.

CONCUSSION, pure and simple, means the effect produced on the brain substance and its circulation from the shock of a blow, fall, or other injury, without any recognisable lesion of its structure. By COMPRESSION is understood the direct and obvious compression of the brain substance and its circulation, whether by depressed bone, as in fracture of the skull, or by fluids, such as blood, serum, or pus, effused within the cranium.

In a case of simple concussion of the brain the patient is insensible, the pulse weak, fluttering, and irregular. The respiration is also irregular; slower perhaps than usual, but not stertorous. The surface of the body is cold, the limbs are flaccid, and there is occasionally loss

of power of the sphincter ani, and either retention or involuntary passage of urine. The pupils are not regularly affected; sometimes they are dilated, at other times contracted, and occasionally one pupil is dilated and the other contracted. The general condition of the patient, immediately after the injury, is that of extreme collapse, with insensibility more or less complete.

The insensibility of concussion, as contrasted with that of compression, differs in degree. In both cases the patient is unconscious, but in concussion the patient can be roused to indicate a perception of external stimuli; thus, by speaking loudly to him, he will try and respond, not by a coherent or even a very articulate answer, but still sufficiently to indicate a certain amount of consciousness. In complete compression the patient is comatose. There is no response to external stimuli, beyond the mere existence of irritability excited by those of a physical nature. Another difference is in the evanescence of the unconsciousness in concussion as compared with compression. In the former the insensibility naturally tends to pass away, unassisted by remedies, consciousness gradually returning.

The first stage of concussion, or concussion proper, may last from a few minutes up to some hours. Gradually the pulse rises, the respiration becomes more regular, and the heat of surface returns. The patient becomes a little restless, and at last opens his eyes as a person awakened from a troubled sleep, stares round him, and after a time becomes sensible of his position. At the beginning of this second stage, as the insensibility begins to pass off, the patient very generally vomits. Occasionally vomiting occurs immediately after the accident, but this is rare. The vomiting, in fact, is an evidence of the existence of some degree of sensibility.

After a short period, during which the patient seems restored to his natural health, another train of symptoms manifest themselves. The pulse becomes quick, sometimes hard and wiry, the skin hot and burning, and the patient complains of headache and thirst. Reactionary fever has set in. Such is the usual course of the phenomena observed in a case of concussion, when unaccompanied by any lesion of the brain, its membranes, or their bloodvessels. When, on reaction, the circulation becomes excited, other symptoms may develop themselves; vessels which have been torn may then begin to bleed, and lead to compression of the brain; or inflammation of the brain or its membranes may supervene, and occasionally give rise to compression from effusion of lymph, serum, or purulent matter within the cranium; but these are effects which require to be considered specially.

The explanation of the symptoms in pure concussion is not very easy. They seem dependent on some temporary derangement of the brain substance, or its circulation, giving rise to functional disturbance of the sensorium, which gradually passes off with the subsidence of the shock which caused it. In cases where the symptoms are more severe and persistent, or lead to any permanent change in the mental or physical condition of the patient, we may infer that some organic lesion has complicated the injury. This view is borne out by what we see in cases of concussion, which terminate fatally, where usually

laceration of the brain substance, or extravasation of blood into the brain is found. In the very rare cases where concussion terminates fatally without reaction occurring, and in which no obvious lesion is found, it is probable that the shock has affected not only the sensorium but also that portion of the nerve centres more essentially concerned in organic life. The late Mr. Vincent was of opinion that the amount of danger in cases of concussion depended on the direction as well as on the degree of the force causing the injury; being greatest when transmitted in a line directed towards the base of the cranium, by which its effect is received on the central parts of the brain, and least when directed in a line at right angles to the vertical lines, the force being then transmitted from side to side on the upper part of the brain, producing but little disturbance of its functions. (See diagram, plate XXVIII., fig. 1.)

Concussion of the brain, when uncomplicated with organic lesion, rarely proves fatal in the early stage; the dangers are chiefly due to those conditions which develop themselves during reaction, and it is against such that you must be chiefly on your guard; but the treatment of the early stage of shock has important bearings on the after-risks, as it may influence materially the subsequent conditions.

First, let me state succinctly and distinctly what I consider should be the treatment, and I will then give you my reasons for avoiding certain things which are sometimes done. Amongst the most important items of treatment are the abstaining from all avoidable movement of the patient, and maintaining him perfectly quiet. External warmth should be applied by means of hot bottles or heated bricks wrapped in flannel; a sinapism may be applied to the epigastrium, and if the collapse is considerable, and the symptoms do not soon improve, a turpentine enema should be administered, which acts as a stimulus, and at the same time relieves the bowels if distended. No internal stimulants should be administered at this stage, unless in very exceptional circumstances. If we attempt to give them in the unconscious state of the patient, unless we use the stomach-tube, there is a chance of suffocation from inability to swallow, and if we administer stimulants by means of the tube we are liable to increase the violence of the reactionary stage, and the risks incident to that. The opposite and even more dangerous interference by bleeding during this early stage of concussion is not so likely to be used as it once was. There are certain conditions supervening on concussion, in which depletion is indicated, and is followed by marked benefit. But to withdraw blood when, from the shock to the nervous system, the circulation is depressed and irregular, and life trembling in the balance, would be very likely to turn the scale the wrong way. I know there are cases on record where venesection has been practised in the first stage of concussion with apparently immediate relief; and I can quite understand that in a case of concussion in which the right side of the heart was distended, venesection might, by relieving the distended organ, benefit the patient; but the case would be marked by congestion of the veins of the neck. Besides, the risks are so evident and so great, that I think it safer to advise you to abstain from so dangerous a remedy.

When reaction has fairly set in, absolute quietude must be enjoined, and prophylactic measures used to ward off over-excitement, and the effects which frequently follow concussion. Cold, by means of ice-bags or cold-water cloths, should be applied to the head, and hot bottles kept at the feet. The patient should be put on low diet, and the bowels kept freely open. Should the pulse become quick and hard, accompanied with headache, or very slow and laboured, with sluggish action of the iris, depletion should at once be employed, either by venesection, or by leeches applied behind the ears. The patient should be carefully watched, and any abnormal conditions met by appropriate treatment.

LECTURE LXXXII.

Rationale of Treatment of Head Injuries founded upon the Pathological Conditions attending them—The immediate and more remote Dangers following Reaction in Concussion; Symptoms attending them; Indications to be derived from these—Active and Passive Extravasation: Diagnosis of its Site—Inflammation of the Brain and its Membranes—Suppuration within the Cranium—Evacuation of the Pus by Perforation,

I HAVE stated dogmatically the treatment which experience has convinced me to be that best suited to ward off subsequent evils, because I think that in cases of emergency it is well that young practitioners should have the general plan of treatment before them in a distinct and easily remembered form. But to enable you to understand the grounds on which the method of treatment is founded, requires me to proceed now to consider the dangers which are liable to follow on concussion, during or subsequent to the reactionary stage. Those dangers are, first, internal hæmorrhage, in either an active or slower form, leading to compression or disease of the brain. Secondly, inflammation of the brain or its membranes, resulting in effusion of serum or coagulable lymph on the surface of the brain, softening of the brain substance, or the formation of purulent matter within the cranium.

The danger which is likely to follow most immediately during reaction, or after it is fairly established, is INTRACRANIAL HÆMORRHAGE, and I shall therefore begin by considering its causes and effects. The cause of intracranial extravasation in concussion may be said in general terms to be rupture of some bloodvessels, generally of small size, by the force which caused the concussion. During the state of shock and collapse the depressed state of the circulation prevents active bleeding; but when reaction commences and proceeds, the circulation becomes excited, and then the ruptured vessels pour out their contents, and lead to symptoms, the character of which will depend on the amount and site of the extravasated blood. If the extravasation be small in amount and situated in the brain substance, or on the surface of the brain, or in a thin layer within the arachnoid membrane, the symptoms at first will not be very urgent or marked, and any symptoms which have appeared may seem to pass off; yet the extravasated blood may, by exciting a chronic inflammatory action, lead to disease of the brain, and at a later period give rise to alteration in its functions, as evidenced by both objective and subjective symptoms, such as impaired vision, paralysis, more or less complete, of parts supplied by some of the intracranial nerves, loss of memory, or other mental disturbance, imbecility, or excitability.

The cases in which the urgent symptoms following concussion mark most clearly the occurrence of intracranial extravasation, are those in which the larger meningeal vessels are ruptured. In such cases the force causing the injury has separated the dura mater from the cranial bones at the point where the blow was received, or at the opposite part of the cranium, by the contre-coup. The minute or larger vascular connections between the bone and membranes are ruptured, and pour out their contents. These press inwards the dura mater and the corresponding hemisphere of the brain, as shown in fig. 158 and plate XXVII, fig. 1, causing symptoms of compression.

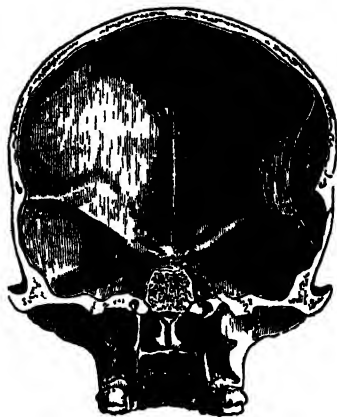


Fig. 158.

Such a case affords, of all others, the best example of compression; and following, as the symptoms do, upon those of concussion, the distinctive characters and points of contrast between the two conditions are best studied. Suppose a case of concussion in which gradually the symptoms of insensibility and collapse have passed off. Moderate reaction has occurred, and the patient has answered questions rationally, and expressed himself free from uneasiness. As reaction proceeds the pulse rises, the face becomes flushed, and he complains of headache, and, perhaps, some sensation of noise, as of rushing water, and becomes hot and restless. By-and-by he falls into a troubled sleep; gradually he becomes still, the sleep is noticed to be profound, and he snores deeply. At length the appearance of the features and the noisy character of the breathing alarm the friends; they try to rouse him, but in vain, and the medical attendant is summoned. He finds the patient's pulse slow and laboured, the breathing stertorous, the pupils of the eyes dilated and insensible to light, and the eyelids and eyes insensible to the touch. The limbs are flaccid, though, in some cases, occasional convulsions and subsultus tendinum occur. The sphincters are relaxed, the patient passes his stools and urine involuntarily, or complete retention of urine takes place from loss of expulsive power. No noise, or question, however loudly put, nor even external stimulus, can rouse the patient, the state of coma being complete. In such a case the train of symptoms enables us to trace cause and effect. The original shock to the cranium, the insensibility caused by that passing away, the interval of consciousness, the excited circulation of reaction, followed by the gradually increasing coma of compression, leave no doubt as to what has taken place. It is a case of active intracranial hæmorrhage, leading to compression of the brain. Such a case points to the necessity for the watchful care and the prophylactic measures I have indicated during the stage of reaction immediately following concussion.

The course and nature of the symptoms in this form of extravasation are so marked as to arrest the attention of even a careless observer. There is, however, another and more insidious form, that of *Gradual or Passive* extravasation, of which I have seen many cases, and to the dangers and treatment of which I drew attention long ago, but more specially in my Clinical Report for 1859-60. This passive hæmorrhage very generally occurs from injury of some of the venous sinuses, but also from the smaller meningeal arteries. Its progress is insidious, and unless we are on the watch for danger, there is nothing in the appearance of the patient which would excite alarm. Generally, he seems to be suffering little from the injury; complains, perhaps, of occasional headache, followed by a dull, uneasy sensation. If we examine carefully we find that the pulse either never rises to the natural standard after the first stage of concussion has passed off, or, what is more common, after having regained its natural frequency, it begins to fall to 60, 52, or 40 beats per minute; this decrease following in a marked manner the occasional attacks of headache. The pupils become rather dilated, and, if tested by the application of light, contract in a sluggish and irregular manner. If these conditions be unnoticed or neglected, the patient, after the lapse of some days, may gradually become comatose; or, more generally, excitement, delirium, squinting, and convulsions, precede by a few hours the symptoms of compression, which close the scene. The great danger in these cases is, as I have already said, that owing to the slight general symptoms, and the trifling alterations in the state of the pulse in the early stages, the surgeon may neglect to guard against subsequent reaction, with its accompanying extravasation.

From what I have seen in the *post-mortem* examinations of cases in which the progress was such as I have described, I believe that the symptoms are due to a passive form of extravasation occurring at different times. Perhaps a certain amount of blood may have been poured out at the time of the accident, or slowly, as the shock passed off, causing a slighter form of compression, as indicated by the somewhat dilated and sluggish pupil and the slow oppressed pulse. If no more extravasation occur, the symptoms may pass off without further bad effects; but if the patient, not feeling very ill, be excited in any way, or allowed to move about, attacks of headache ensue. Each attack, attended by falling of the pulse, and greater dilatation and sluggishness of the pupil, marks the further effusion of blood. Next, the clot so increased in bulk, may, by its presence, excite irritation of the brain and its membranes; and then we have the delirium and squinting without apparent excitement of the pulse; but soon, as the escape of blood becomes more rapid from the restlessly excited state of the patient, sudden convulsions, followed by complete compression, result. In one fatal case, where the original injury was stated to be very slight, and where the patient could scarcely be made to see the necessity for any treatment, death occurred on the fifteenth day after the injury, preceded by excitement suddenly terminating in compression. On examination I found an enormous amount of blood effused, the greater portion of the mass being quite soft, and evidently recent.

whilst other portions, varying in consistence, showed that the extravasation had occurred at different times.¹

Connecting these *post-mortem* appearances with the train of symptoms observed in such cases, I have long considered the slow oppressed pulse and sluggish pupil, especially when preceded by fits of headache, and the sensation described by patients as being like a "rushing sound or feeling" in the head, as indications for diminishing the force of the cerebral circulation, so as to prevent further extravasation. The means I use to fulfil this indication are, depletion by means of leeches applied to the mastoid region; venesection in cases where the patient is young and strong; cold applications to the head, and free purgation. In a great many cases, if leeches be applied to the mastoid region, when the pulse is first noticed becoming slow, after reaction has been established, they will be found sufficient, if combined with cold to the head and the use of purgatives; but if the symptoms threaten to recur, the leeching should be repeated. In severe cases I have found most decided benefit from venesection, in alleviating the dull headache and tendency to coma, at the same time relieving the cerebral oppression, as evidenced by the slow laboured pulse soon becoming more normal, and by the rapid improvement of all the other symptoms. In young and robust persons I have repeated the bleeding with advantage; but even in those of more advanced age or weaker constitution, it may be practised with perfect safety, if we carefully watch its effects, seeing that we can arrest the depletion when we please.

If antimony could be employed without the risk of inducing vomiting, it would be serviceable in preventing reaction after depletion; but, unfortunately, even in minute doses, it is so uncertain in this respect, that I seldom have recourse to it.

At a more remote period after the injury has been received—from the fifteenth to the twentieth day, or later—a similar train of symptoms, though less marked, sets in, depending, I believe, upon serous effusion from subacute or chronic congestion of the vessels of the membranes. In those cases blisters to the nape of the neck or occipital region, combined with the use of mercurials and laxatives, will generally be found the most efficacious plan of treatment; but even at this stage I have occasionally had recourse to leeches with great benefit.

In regard to the position of the extravasated blood, in all forms of intracranial hæmorrhage, that is very uncertain. It may be between the bone and dura mater at the part struck, or at the point directly opposite, on the other side of the cranium, or it may be within the membranes of the brain, or in the substance of the brain. In the cases where the blood is poured out between the bone and dura mater, the clot is more localised and circumscribed, and within reach of surgical interference, if only we had some definite indication of its position. In general, the urgency of the symptoms and the position of the seat of the injury, in relation to the middle meningeal artery or its branches, form the only warrant for the surgeon to have recourse to the operation of trephine to enable him to remove the clot, and so relieve the brain,

¹ See Clinical Cases.

but there must always be uncertainty. In a case of active intracranial hæmorrhage, where the compression is complete and no amelioration follows the use of remedies, such as cold applications, depletion, and purgation, and where the seat of the injury is over or near the line of a large meningeal vessel, the operation ought to be resorted to as giving a chance for life. If the extravasation were not found there, I would even go the length of repeating the perforation at the point of contrecoup; but when the extravasation is within the membranes, the blood is so diffused towards the base of the brain that it could not be removed even if found, and hence operative measures are scarcely warranted.

INFLAMMATION OF THE BRAIN OR ITS MEMBRANES, as a consequence of concussion, is the other danger which we have to guard against. In such cases, the train of symptoms and the period at which they supervene, are in general sufficiently diagnostic. Even in the passive form of extravasation, which I have alluded to, although some of the symptoms are those of excitement, and though the more marked symptoms of extravasation occur at a later period than in cases of active intracranial hæmorrhage, yet, when we are on the watch, the indications of extravasation are evident from symptoms such as the slow laboured pulse and sluggish contraction of the pupils occurring at a comparatively early period after reaction; whereas, in the case of inflammation of the cerebral membranes or substance, the symptoms never appear immediately after reaction is established; but generally from the sixth to the tenth day—seldom before the eighth day. Up to that date the patient probably progresses well, complaining little of uneasiness beyond occasional attacks of headache, and without any great increase in the frequency of the pulse.

The most common premonitory symptoms are anxious expression and sleeplessness, though these are not always present. About the sixth day the patient feels rather out of sorts, his appetite fails, the tongue is white and loaded, and he complains of headache, the character of which he describes as if a cord were tied round the head; or else he complains of feeling a general tension about the head. The skin becomes hot and dry, and he has either a slight or well-marked rigor. The pulse becomes hard, wiry, and very frequent. Then follow intolerance of light and sound, and all the other symptoms of fever. The patient has an excited look, the eyes are restless and brilliant, and he starts and speaks during sleep. Delirium, generally of a violent frenzied character, supervenes. This state of matters, unless it yields to treatment, goes on increasingly, till it gradually terminates in low muttering, delirium, and coma. In some cases the symptoms indicate the formation of purulent matter within the cranium. After the phrenitic symptoms have lasted for some time, usually about the tenth or twelfth day from the receipt of the injury, a very decided rigor occurs, succeeded by perspiration. The general febrile symptoms are less, but there is a tendency to low muttering delirium, a semi-comatose state. Not unfrequently aphasia, paralysis, in the form of hemiplegia, or of some particular set of nerves, such as the facial, makes its appearance,

and there are convulsions, subsultus tendinum, and these culminate in symptoms of compression.

These latter symptoms may arise either from effusion of serum or lymph on the surface of the brain or into the ventricles, or from suppuration and effusion of purulent matter between the bones and dura mater, or into the cavity of the arachnoid. In the cases where the effusion is either into the cavity of the arachnoid or sub-arachnoid, any surgical interference can be of little use, as the fluid, whether serous or sero-purulent, is generally diffused, and cannot be thoroughly evacuated. There are, however, cases in which trephining has afforded relief, and as the state of the patient is otherwise hopeless, this chance of relief may be given.¹ When, however, it is situated between the bone and dura mater, it is more likely to be localised, and may be evacuated by operation. It is therefore of importance to note any indication which may guide us to the position of the effused matter. Unfortunately, such indications as we have are neither very decided nor satisfactory as to the exact locality of the effusion. Hemiplegia is so far a general indication as evidencing pressure on the brain, and it is also usually indicative that the matter is situated over the hemisphere of the brain opposite to the paralysed side; yet in several cases the contrary has been found to be the case; and again, it may arise from sub-arachnoid effusion, or abscess in the brain substance itself.

Mr. Pott, in his great work on injuries of the head, drew attention to the state of the scalp in certain cases, as indicating in conjunction with the other symptoms, the position of pus, when placed between the bone and dura mater. He stated that in such cases the suppuration between the bone and dura mater affected the vitality of the bone; and that, owing to vascular connections, the pericranium would also suffer, and hence that unhealthy suppuration would occur under the scalp at the affected point. That in such cases, if the scalp was entire, a puffy or boggy tumour occurred at the part, or if a wound of the scalp existed, as the internal diseased action proceeded the external wound became unhealthy, its edges everted, the discharge thin and gleety, and the bone could be seen bare at the bottom of the wound, and that the intracranial suppuration would be found to correspond. The "puffy tumour" of Pott has been considered by recent authors as not being much to be depended on as a diagnostic, and is spoken of as being rarely met with. My experience has been different. I have had occasion to trephine in several cases for purulent matter, and in these cases one or other of the conditions described by Pott served as my guide to the pus. I suspect the term "puffy tumour" may possibly have led some to expect the presence of a distinct prominent swelling. In some cases it is so, but most generally it is merely a boggy tumefaction or flattened swelling under and in the scalp tissue, at the part corresponding to the internal collection of pus (plate XXVII., fig. 4).

As regards the value of the indications alluded to, it must be obvious that they are not absolutely certain. A simple contusion of the scalp tissue may be followed by suppuration of unhealthy character,

¹ See case of Kely in *Clinical Cases*, p. 797.

and give rise to a boggy swelling; or a scalp wound, in which the pericranium has suffered, may be followed by necrosis of the surface of the bone, and then the wound would present the unhealthy appearance described, and it may so happen that the general head symptoms may be coincident with such local symptoms. It is quite true that suppuration between the bone and dura mater may occur without these local conditions, and also, that when they are present, perforation of the cranium may disclose nothing beyond a sloughy state of the dura mater, and perhaps a thin layer of yellow lymph, scarcely purulent matter. Still, as a general practical rule, if we have the symptoms of intracranial suppuration, and one or other of these local conditions be present, they form the best guides the surgeon has as to the position of the suspected purulent collection. My own opinion is, that the cases in which these local conditions described by Pott exist, are cases in which the cranial bone and its pericranium have suffered severe contusion, followed by inflammation of the internal membrane, and hence the distinctly localised result; whilst, in cases where general meningitis follows concussion, and terminates in suppuration between the bone and dura mater, these local indications may be absent.

The *Treatment* of inflammation of the brain or its membranes requires to be active, and to be successful must deal with the disease in its early stage. Indeed, here, as in regard to intracranial extravasation, prophylactic treatment during and after the stage of reaction is that which is of most avail; and hence the surgeon should never look on any injury of the head as too slight for anxiety and watchfulness. He ought always to bear in mind that the diseased condition may supervene very insidiously, and that the diagnostic symptoms rarely occur till a week or ten days after the injury, sometimes much later; hence the necessity for quiet, and careful regimen, even when all seems going on favourably.

In the early stage of meningeal inflammation, the most perfect quietude is essential, and the light of the apartment should be subdued. Cold applications, such as ice-bags, or iced-water cloths, should be kept at the head. The bowels should be thoroughly cleared out by a purgative and an enema, and subsequently alterative doses of calomel or gray powder may be occasionally prescribed with advantage. When the headache is severe, and the face flushed, depletion by means of leeches, or even by venesection, should be had recourse to; for, however unfashionable the practice may now be, I know from experience that it relieves congestion and affords relief. The assistance of antimony can rarely be obtained, as it is apt to induce vomiting. Aconite (Fleming's tincture), in small doses of a drop, or half a drop, in water, every three hours, may be used with greater safety, to keep down the circulation after the depletion. When the restlessness is very great, and there is delirium and excitement, opiates may be given, though, as a general rule, we wish to avoid their use in head cases. In several instances of watchfulness, restlessness, and delirium, I have found excellent results follow the use of bromide of potassium in large doses, and I much prefer it to opium in such cases. In the later stages of the diseased action, when we have muttering, delirium, slight paralysis, or

a tendency to coma, and in which the originally contracted pupils have become dilated, and do not answer readily to the stimulus of light—in other words, when we have reason to suspect effusion either of serum or lymph—the use of a blister to the nape of the neck, or over the scalp, produces often very marked benefit, and it should be applied before the symptoms have made much progress. Mercurials may also be of use in this stage, to promote absorption of any plastic effusion. The diet requires to be carefully attended to. At first it should be strictly antiphlogistic, but in the later stages we often require to give stimulants and animal soup to support the patient; and in most cases, when the more urgent symptoms have been subdued and the tongue become tolerably clean, the exhibition of quinine as a tonic will be found of great service in promoting convalescence, and relieving the peculiar nervous headache which is generally present. The quinine should be given in small doses at first, combined with dilute nitric or nitro-muriatic acid, and the dose gradually increased up to three grains twice or thrice a day.

When the symptoms arise which indicate that the inflammatory action has terminated in suppuration within the cranium, we must consider whether we can by perforation of the cranium reach and evacuate the pus. I have already pointed out the two conditions which, in my opinion, form the best guides as to the locality of the purulent collection, when situated between the bone and the dura mater. When we have either the puffy tumour or the unhealthy wound and bare bone at the site of injury, or even when there is tenderness of the scalp at one point, as evidenced by the effect of pressure, and when the symptoms are evidently progressing unfavourably, I think our plain duty is to give the patient what little chance there is for life, and his chance will be all the better that we do not delay the operation too long. If we wait till symptoms of complete compression arise, we wait too long. The amount of pus present is very seldom such as would cause compression of itself; and when that condition supervenes, in connection with suppuration, it will be found to be chiefly due to the inflammation extending to the arachnoid and pia mater, and leading to serous or plastic effusion on the surface and into the ventricles of the brain, and not to the purulent collection between the bone and dura mater. Indeed, so far as I have noticed, the symptoms of complete compression are rarely if ever present in such cases till just before death. The symptoms are generally semi-consciousness, irritability, aphasia, and occasional convulsions or facial paralysis, together with the severe rigors which precede these symptoms, and recur from time to time.

Even under the most favourable circumstances the operation of trepan, when performed for the purpose of evacuating intracranial purulent collections, cannot be expected to furnish many successful results. The very existence of pus, and the symptoms which warrant the surgeon in performing the operation, indicate that inflammation of the membranes has been proceeding for some time, and argue the existence of such morbid processes as are most unfavourable as regards the prospect of recovery. Even when we find and evacuate a purulent collection between the bone and membrane, we can never be sure

whether, or to what extent, the brain itself may have suffered from the diseased action. Hence the operation can only be regarded as a chance afforded to a patient under otherwise desperate circumstances. But we must take care that we give that chance for life in good time, and not wait till there is no reasonable hope left, and when the result can only bring discredit on the operation.

In one case on which I operated early, and where the symptoms had not fully developed themselves, only a very little sero-purulent matter escaped, yet the patient mended from the time of the operation.

In speaking of the conditions of concussion and compression, I have, for the sake of description, taken typical cases of each ; but I stated at first that we frequently meet with cases of severe concussion, in which the symptoms are not easily distinguished from those of compression. Thus, in some cases of concussion, the insensibility is very profound, and the pupils dilated, and the patient passes his stools and urine involuntarily. In other cases we have the deep unconsciousness, subsultus, and clenching of the thumbs, together with convulsions and strabismus. Such symptoms indicate pretty clearly that there is something more than mere cerebral shock ; that there is either lesion of the brain substance, or that some extravasation has taken place at the time of the injury, and hence the mixture of symptoms of compression with those of concussion. In cases in which convulsions and strabismus are marked symptoms, whether after concussion or fracture of the cranium, they indicate laceration of the brain substance, generally towards the centre or base of the organ, and the result is almost uniformly fatal.

LECTURE LXXXIII.

Injuries of the Cranial Bones—Contusions—Fractures—Ecrasement or Smash—Fractures with and without Depression, as Fissures, and Simple, Compound, Compound Comminuted, and Punctured Fractures—Fractures of Base of Skull—General Symptoms and Treatment exemplified by Cases.

THE effects of injuries of the cranial bones come next to be considered. For the sake of brevity I shall treat of them under the heads of Contusion and Fracture.

CONTUSION OF THE CRANIAL BONES is almost invariably combined with more or less severe concussion, and it may be attended by internal extravasation and other results of concussion already alluded to. More especially, I believe it to be the form of injury most likely to lead to suppuration between the bone and dura mater, in consequence of the impaired vitality of the bone, and its separation from the pericranial and meningeal connections, giving rise to unhealthy action. These conditions having been already fully considered, I will, under this head, merely allude to the fact that contusion of the cranial bones, apart from the more immediate and urgent conditions already spoken of, may give rise to chronic affections of a serious nature, from cario-necrosis of the injured bone, leading to alteration of the membranes of the brain and erysipeloid affections of the scalp; or, the injured bone may become thickened, or irregularly nodulated on its internal surface, so as to press upon and excite chronic disease of the brain itself. In such cases epileptic attacks are very commonly the result: and occasionally intermittent maniacal symptoms supervene, when, from any exciting cause, an exacerbation of the chronic osteitis is induced.

I need hardly say that when once such a state of matters is established, our remedies are not very efficacious, and that we must trust chiefly to the prophylactic measures recommended when treating of the effects of concussion, and to the active treatment of the early or acute stage of the inflammation which follows the contusion. In cases of chronic cranial osteitis following contusion, in which, from the attacks of headache and excitement, and the external tenderness of the scalp and bone, we suspect or ascertain that bone is the seat of inflammatory thickening, depletion by leeches, or, better still, by incisions through the scalp over the affected bone, will be found to afford great relief; and, if followed up by the use of a course of iodide of potassium combined with the bromide, and at a later period by the application of repeated blisters, permanent benefit may be effected. In certain cases

where epileptic fits have followed contusion of the bone, and especially if there be marked tenderness on pressure, or a tendency to the fits being induced by such pressure, the operation of trephining the bone, with a view of removing the source of cerebral irritation, has occasionally succeeded in effecting a cure ; but it has frequently failed ; and as the risk of a fatal issue is considerable, I would not counsel you to have recourse to it except in severe cases, when the local irritation is well marked.

FRACTURE OF THE CRANIUM, even in its slightest form, is an injury attended with very great risk, because the existence of such a lesion indicates an amount of force applied to the cranium which would be likely to lead to serious results. It is well, however, to bear in mind, in reference to fractures of the cranial bones, that there is nothing peculiarly dangerous in the fracture itself, but that the danger is owing to the relation of the injured bone to the brain, and that this consideration is what influences our treatment of such injuries.

Fractures of the cranium are classified according to their position or character. Thus, in reference to position, we have them divided into fractures of the cranial vault and fractures of the base of the cranium ; an important classification practically, as the former division includes fractures of those portions of the skull which admit of direct surgical interference by operative procedure ; the latter, those in which our treatment is limited to indirect measures, owing to the position of the injury.

The classification of fractures of the skull, according to their characters, includes, first, their condition as simple or compound,—conditions which, though important in all fractures, are very specially so in cranial fractures, as influencing in a marked manner our treatment of the cases. Lastly, the subdivisions of cranial fractures, founded upon their peculiar characters, are—fracture without depression, which includes the different degrees of fissure ; simple fracture with depression ; compound fracture with depression ; and compound comminuted fracture with depression ; punctured or stellate fracture ; and lastly, what is termed by French surgeons “*ecrasement*” or smash, extensive comminuted fracture of the cranium. Fracture of one of the tables of the skull may occur without fracture of the other, and occasionally it happens that the internal is the table injured, whilst the outer has escaped injury.

Fissure of the bones of the cranial vault varies from a mere capillary fissure to a fissured fracture without depression, extending throughout the whole length and thickness of one of the bones, or even passing through several bones and the connecting sutures. Such an injury may be followed by grave danger, from the force which inflicted it affecting the contained organs, and leading to intracranial extravasation or inflammation. Hence a necessity for prophylactic measures, and for watching the patient for some time in case of mischief arising. But a fissured fracture neither admits of nor requires any interference with the fractured bone, except in cases in which compression from extravasation occurs, and in which the fissure traverses the course of a large bloodvessel,—as, for example, a fissure through the anterior and

lower part of the parietal bone. In that case, the existence of the fissure, if symptoms of compression arise, is a warrant for trephining, with the view of removing the extravasated blood. In cases of fissured fracture we sometimes find the fissure at the opposite point of the vault from that on which the injury was received; and not unfrequently we have fissure both at the point struck and at the opposite side. Fracture, without depression, is merely a severe form of fissure.

The importance of depression in fracture of the cranium, whether simple or compound, is in proportion to the amount of displacement in the level of the bone, and consequent pressure on the brain. The extent of the depressed surface does not seem to affect the cerebral functions so much as the abrupt depression of a smaller portion, and does not in general so urgently demand operative interference. It is wonderful how the brain seems gradually to accommodate itself to a very considerable depression, diffused over a large surface, unless the depression be very deep. In children and young persons, the cranial bones are soft and elastic, and after a time regain nearly their normal level; but, even in adults, the effects produced by depression of a large surface are less severe and more transitory than we might expect, and this is one reason which causes the surgeon to be chary in trephining in such cases until other means have been tried. In simple fractures of this kind, especially in the young, no interference is warrantable at first, unless the symptoms of compression are very urgent, and resist other treatment. In such cases it will generally be found that, along with the depression of the bone, there is extravasation of blood. Indeed, the result of my own experience makes me doubt whether the displacement of the bone, in any ordinary depressed fracture of the vault of the cranium, ever causes complete compression. In many cases which I have seen, both of simple and compound fractures, with even abrupt depression, the symptoms of compression have been almost absent, and in none have they been so well marked as they are in cases of active intracranial hæmorrhage, whilst in others, in which the symptoms of compression increased and proved fatal, extravasation was uniformly present. In these last cases, indeed, the very progress of the symptoms enabled me to predict confidently that we would find extravasation superadded to the fracture.

In fractures at the base of the cranium, the case is somewhat different, for in such injuries the broken bones are projected upwards, and impinge directly on the most important parts of the brain, and so may produce more urgent symptoms; but here, also, besides the fracture, there is usually extravasation from injury of the vessels at the base of the skull.

Simple fracture, with depression, varies in degree; and the intensity of the symptoms of cerebral lesion or of compression will depend, as I have just said, partly on the extent, but principally on the depth of the depression, and whether it be complicated with intracranial extravasation or fissure, extending from the fracture towards or through the base of the skull. When limited, and the depression not deep, and uncomplicated with internal hæmorrhage, the symptoms present at first may be merely those of concussion, or of a very slight degree of compression,

which, under treatment, will pass away. If, in such a case, the symptoms, instead of diminishing, gradually assume the more decided characters of compression, this increase is pretty clear evidence that the cause of the increased compression is due to extravasation of blood from lacerated vessels, and not to the fracture, as the compression caused by the depressed bone would take place at once and not increase. Indeed, the brain gradually accommodates itself to the compression, originally caused by depressed bone. In children, owing to the soft resilient character of the cranial bones, what was originally a deep depression often disappears, or at least the depressed surface so nearly regains its natural level as not to cause any inconvenience, and scarcely to be perceptible to the touch. The correct diagnosis of simple fractures of the cranial bones is most important, as the extravasation into or under the scalp tissue, which has already been spoken of, might mislead the surgeon to suppose there was depressed fracture when no such lesion existed, and so lead to dangerous practice.

Compound and compound comminuted fracture may be considered under the same head, as differing only in degree, for all cranial fractures, except simple fissures, are more or less comminuted. In compound fractures the wound of the scalp enables us to see and feel the extent and nature of the fracture and to judge of the amount of the depression, and the probability of the existence of depressed sharp projecting points of bone or loose fragments of the skull, and so guides us as to the treatment necessary. When the scalp wound is too small to enable us to examine the full extent of the fracture, it can be enlarged sufficiently for that purpose. In some cases, however, the external appearance of the bone might mislead, as, for example, when the injury has been inflicted with a sharp-edged missile, such as a quoit thrown with great force, the edges of the wound in the bone look comparatively smooth, and not much depressed, when in reality a narrow portion is driven in and impacted, and the internal table extensively broken up; and I have seen the same thing occur from the kick of a horse. This condition is most liable to occur in fractures of the frontal bone. In all cases, besides the appearance or the fracture, we must take into account the nature and degree of the force causing the injury.¹



Fig. 159

Punctured fractures are those in which the injury is inflicted by the patient falling from a height on some sharp-pointed body, as an angular piece of stone, or the spike of a rail; or when the patient is forcibly struck on the cranium by some sharp-pointed body, as, for example, by a sharp fragment of rock projected by the explosion of a shot in mining, or by a pitch-fork falling from the top of a hay-rick, or similar causes. In such cases the accident

Fig. 159. Punctured fracture with detached fragments.

¹ See Clinical Cases.

looks trivial, as there is only a small scalp-wound, and a mere punctured depression or small hole seen in the outer table of the skull, and the patient suffers little or nothing at first; there is seldom even slight concussion. The inner or vitreous table of the skull, however, suffers in general to a much greater extent. It is either projected inwards in an angular manner on the dura mater, or extensively comminuted in a star-like or radiating manner, numerous loose detached portions lying between the bone and dura mater, which is separated more or less extensively by the projecting force. Hence the term stellate or radiating fracture is sometimes used to denote this form of punctured fracture (fig. 159).

The usual explanation of these effects of a punctured fracture of the cranium is, that whilst the outer fibrous and more resisting table of the skull is merely perforated, the extremely brittle, internal, or vitreous table is largely comminuted and projected inwards. The brittle character of the vitreous table no doubt explains to a certain extent the amount of comminution, but the real explanation of the effect produced is to be found in the direction of the force. Here, as in a bullet-wound, the point of entrance is small, the point of exit large, and the inner table driven aside in fragments. Any one may satisfy himself of this by inflicting forcibly on the dead subject a punctured fracture from the interior of the skull outwards, when it will be found that the outer table will be projected outwards, though perhaps not comminuted to the same extent as the vitreous table when the punctured fracture is caused in the usual way, because, in the latter, both the direction of the force and the brittle texture of the internal table combine to produce great comminution. Suicidal gunshot wounds, inflicted with a small pistol-ball, fired from within the mouth, cause large comminution and eversion of the outer table of the skull when the ball perforates the cranium, showing the effects of the direction of the force causing the fracture. It is most essential to bear in mind the condition of the bone in punctured fracture in relation to the brain and its membranes, so as to understand the reasons which induce us to interfere at once in such fractures, although no bad symptoms may be present. In these cases, it is indeed rare to have any untoward symptoms until six, eight, or ten days after the injury, when the usual symptoms—meningitis and intracranial suppuration—begin to manifest themselves.

Fracture of one of the tables of the skull may occur, but such injuries are rare. I have never in my own practice met with such an injury, and I should think it must almost be limited to the frontal bone, in which the divergence of the tables at the frontal sinuses might admit of the one yielding alone without implicating the other. Thus, a direct blow might break the outer table over the frontal sinus and the inner not yield to the force; or, in a fall on the occiput, the effect of the "contre-coup" might split or fissure the inner table at the frontal sinus without similarly affecting the outer table. In the case of the more serious lesion, fracture and probable comminution of the internal table alone—in which, as in punctured fracture, it would be proper to interfere if we could determine the existence and site of the fracture—I can scarcely conceive of any diagnostic symptom to warrant inter-

ference until those of intracranial suppuration begin to manifest themselves, and then the chances of successful interference would be small.

"Ecrasement," or smash of the cranial bones, is usually the result of great force; as when a person falls from a great height, or when a heavy weight or force crushes the skull, or as the result of a gunshot wound, as when a heavy charge of small-shot strikes the vault of the cranium obliquely. In such cases, as may be readily conceived, the injury is almost immediately fatal. But there are degrees in this as in every form of injury, and even most unlikely cases recover, as that of the girl J. S——r, which will be found in the Clinical Cases; so that we must never despair, even under unfavourable circumstances, but do what we can to assist the curative powers of nature.

In the *Treatment* of ordinary depressed fracture of the cranial vault, we must keep in mind that the danger depends on the relation of the bone to the brain and its membranes. In simple depressed fracture, even if there be symptoms of compression present at the time, we do not interfere immediately by trephining. We apply cold to the head, give purgatives, and in some cases deplete. If, notwithstanding these measures, the symptoms go on without improvement, then, especially in the adult, it is proper to cut down on the fracture, elevate the depressed bone, and remove any loose fragments which may be present; but we are not warranted in doing this unless the symptoms of compression do not yield to treatment. In young patients we should be very slow to interfere, as the bones possess great elasticity, and the symptoms of compression may gradually pass off.

In a depressed compound fracture of the skull, in which the bone is usually much broken up, and portions abruptly depressed, with perhaps a point of bone projecting inwards, we ought to lose no time in trephining, although symptoms of compression be slight or altogether wanting. Here we superadd no danger by operating. We are not converting a simple fracture into a compound one, as in the former case, whilst the benefit derived from elevating or removing the depressed portion or removing loose fragments is obvious. When the bone in a compound fracture is fissured, without being much comminuted or depressed, no one would think of trepanning at once, for no bad consequences may result from such a fissure, and the mere co-existence of a wound of the scalp does not greatly increase the danger. But when the fracture is comminuted or depressed, we should operate at once.

From what I have stated regarding the character of the punctured and stellate fracture, I trust you will see the propriety for promptitude in its treatment. You must not be beguiled into false security by the trivial appearance of the injury, or the absence of bad symptoms at the time. Keep in mind the state of the injured bone, and its relation to the brain and dura mater. It must be obvious to you that the projecting points of the table driven in upon the dura mater must irritate, if not lacerate that membrane, or even the brain itself, and that the detached fragments, deprived of their vitality, will act as foreign bodies, which, as they have no means of escape, must necessarily lead to intracranial inflammation and suppuration, unless an operation be performed to remove these sources of irritation. This, to be of service,

should be done at once. If done early, we remove the fragments and depressed portions of the internal table before they have lacerated or punctured the dura mater, or excited inflammation, and so prevent bad consequences. If we wait till urgent symptoms supervene, our interference is too late; the mischief already done generally proves fatal. Although it is still our duty to give the patient a chance for life, as some few cases have recovered from removal of the fragments of bone, and escape of purulent matter, even when the operation has been performed late; yet these are rare exceptions, and should not weigh with us as a reason for delay. A different opinion in regard to the treatment of punctured fractures of the cranium is held by some surgeons, who refer to cases in which patients have recovered without dangerous conditions supervening. I can only look on such cases as exceptional, in which, by some lucky chance, fragments had not been detached. But from what I have stated as to the conditions of the cranial bone in punctured fractures, I cannot admit that such exceptional cases should regulate our practice. The operation of trephining should be done at once, and all fragments of bone carefully removed; and when that is done the patients generally make good recoveries, and require little more than cold-water dressings to the wound, low diet, and attention to keep the bowels freely open, and, of course, absolute rest and quiet.

Fractures of the base of the cranium are the cases in which there is the greatest amount of compression and of danger, for, besides the extensive breaking up of the bone and projection of small fragments of it into the most important parts of the brain, there is a great risk of the vessels at the base of the brain being injured. Many, in fact, consider these fractures as uniformly fatal.

The general symptoms of such a fracture are those of compression, with bleeding from the nose, mouth, and ear. When there is bleeding from the nostrils, the ethmoid bone is generally broken, and the anterior part of the base of the skull split up. A blow upon the nose with the fist may even cause fracture of the base of the skull, by breaking up the ethmoid, nasal, and turbinated bones. In some cases of fracture of the base of the skull the bleeding takes place from the ear only, and not from the nose or mouth. It must, however, be remembered, that bleedings from the nose, mouth, or ears, are not absolute diagnostics

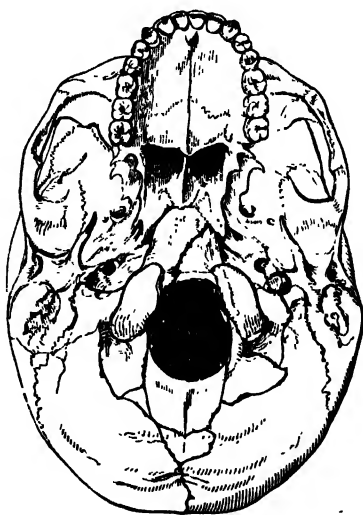


Fig. 100.

Fig. 160. Fissure at the base of the skull, involving the occipital and sphenoid bones. The patient fell from a ladder on the vertex, and lay comatose for some days before death. Extensive extravasation was found over the cerebellum and middle lobes of the brain. — LISGON.

of this injury, as they may arise from rupture of the lining membranes of these parts in comparatively slight injuries. The force required to cause this injury is very considerable. In some cases there may be a depressed fracture on the vertex, and along with it extensive fissures passing down towards and causing fracture of the base of the cranium (see fig. 160). The accident may occur from a person receiving a heavy blow upon the vertex, or from falling upon the occipital protuberance, fissures extending from the point struck to the base. Or it may occur from the patient falling in the sitting posture; the head being still in motion is forced against the spinal column which has come to rest, and the base of the cranium is thus broken up extensively. Most generally it occurs from a fall upon the vertex, or from heavy bodies falling upon it. In some cases the symptoms are very intense: if the symptoms of compression do not come on at first, they soon do so; when they are not very marked at first but become so subsequently, it is probable that effusion of blood has taken place secondarily, and caused the urgent symptoms of compression. These cases, as I have said, are considered by some to be almost uniformly fatal; but my own experience does not confirm this, for several well-marked cases under my charge have recovered under proper treatment, and it is certainly not right to lay down such an absolute statement as to their fatality, as it might lead to a want of sufficient care in treating them.

The general treatment of fracture of the base of the skull is just that recommended for compression—the application of cold to the head, depletion to prevent further extravasation of blood taking place, absolute rest, and attention to the state of the bowels. By these means the very severe symptoms are often relieved. We can thus do something to prevent further extravasation of blood taking place to any great extent, and it is to that the fatal results are principally due.

It sometimes happens that in depressed fracture of the skull some sharp fragment may wound the longitudinal sinus, or the depression may be so situated that the operation for the elevation or removal of the depressed and comminuted bone may unavoidably implicate the sinus. In either case the complication is a serious one, but it is not now regarded with the dread it once was. Formerly it was supposed that the bleeding would be uncontrollable; but experience has shown that, whilst the bleeding may prove dangerous in some instances, in many it is easily controlled. In my own practice I have met with five cases in which sharp fragments of bone had penetrated the longitudinal sinus; in two of them the hæmorrhage was profuse and impetuous at first, but was not very difficult to control. One of the patients, a young lad, received a blow on the vertex with a piece of stone which was blown down with great force from the parapet of a high house. The bone was broken in fragments, most of which were loose and easily removed, except one, which seemed driven across the line of the sagittal suture. It was impacted, and evidently must have wounded the sinus; but it was absolutely necessary to remove it. The instant I withdrew the fragment a profuse gush of venous blood poured out from a large wound in the vessel, and the amount lost before I could put my finger on the opening was almost incredible, but the pressure of my finger at once

arrested it. On moving the finger to apply a compress of lint, the blood again gushed out, but the lint, supported by a single turn of bandage tied from over the vertex and fastened under the chin, served completely to arrest it, and when the dressing was removed, forty-eight hours afterwards, there was no tendency to bleeding. In another case, a man received a blow with a quoit, which struck him about the upper part of the occipital bone, inflicting a transverse wound about an inch and a half long across the line of the longitudinal sinus, near its confluence with the other sinuses. The bone was rather cut than fractured, and a portion of the margin which had been indented was drawn out along with the scalp, when I proceeded to examine the wound. On this being done a profuse gush of dark blood followed. I checked it at once with my finger; but as I considered it necessary to examine the state of the bone in case of fragments of the inner table having been detached, I required to examine with a probe, and during the time I was so engaged, the bleeding was active, though not so violent as at first. Having satisfied myself that there were no loose fragments projected, I placed a compress of lint over the wound, applied ice-bags to the head, and kept the patient in the prone position for some days, and under strict antiphlogistic treatment. He made a good recovery, and there was no more bleeding. In this case I was apprehensive lest the blood, prevented from escaping externally, might lead to intracranial extravasation and compression, and I had the patient carefully watched, determining to trephine in case of these conditions arising, but no occasion for interference occurred. Probably the attachments of the dura mater had not been separated by the force causing the injury. In the other cases the injuries of the sinus were merely punctures, and though the jet of venous blood was forcible, there was nothing like alarming hæmorrhage. In regard to the risk of trepanning over the sinus or close to it, I believe that, unless the fractured bone has injured it, if due care be taken in using the trephine, the sinus may escape being wounded. I have twice trephined over the sinus, and in both cases the bone was removed without the upper membrane closing the sinus being opened. In cases where there are sharp shelving points of the internal table of the skull, the movement of the trephine in working it may cause injury to the sinus.

Although this complication is neither so much dreaded as formerly, nor should prevent the surgeon interfering in cases requiring operation for removal of fragments of bone, which must, if left, prove dangerous, still, as I have said, it is a serious complication, and, apart from the risk of hæmorrhage, may lead to fatal phlebitis. In the case of the lad I have mentioned, who had fracture of the vertex, the head symptoms were mixed up with those of phlebitis, and when examined after death, the large sinuses presented fibrinous clots and broken-down unhealthy matter, exactly similar to what I found in a case in which I required to tie the internal jugular vein in a suicidal wound high in the neck, where the patient died undoubtedly from phlebotic pyæmia; that the more prominent danger—hæmorrhage—is not the only or even the greatest risk of this complication.

LECTURE LXXXIV.

Hernia Cerebri: its Nature, Causes, and Treatment—The Operation of Trepan Instruments required, and Mode of performing it, how modified by the Nature of the Injury—General After-treatment—Brief Statement of the Cases where Trepan should be performed.

FUNGUS, or HERNIA CEREBRI, is the term used to denote the fungoid protrusion which occasionally follows an aperture in the cranial vault, whether the opening has resulted from an operation such as trepan, or removing loose portions of fractured bone, or has arisen from disease leading to death and exfoliation of the bone. If as sometimes happens in the case of injuries, the dura mater or the brain itself has been lacerated by the fractured bone, so soon as the bone is removed the pulsatory motion of the brain tends to project the brain-substance through the lacerated membrane, and the aperture in the bone. In cases where the dura mater is entire, or merely punctured, the protrusion occurs more slowly. The membrane is projected against the sharp edges of the trephine wound, or the irregular margins left after removal of some loose fragments of fractured bone. This gives rise to irritation, interrupted circulation, and at last sloughing, of the dura mater, corresponding to the part whence the natural osseous support has been removed; and then projection of the cerebral fungus gradually takes place. In some instances, as I have seen in gunshot fracture of the parietal bone, the dura mater, though not lacerated or wounded, has its vitality affected by the injury, and presents an opaque leathery appearance when the fragments of bone are removed; the sloughing of the membrane takes place very rapidly, and a large though not very prominent fungus protrudes. (See plate XXVII, figs. 2 and 3.) I believe, however, that in most, if not in all cases of fungus cerebri, there are other causes in operation besides those mentioned, and that laceration, extravasation, and most frequently unhealthy suppuration in the brain-substance underlying the protrusion, will be found present. These last-mentioned conditions were long ago pointed out by Abernethy and others, and Mr. Hill, in his *Surgical Cases*, details a case in which the fungus was accompanied by, and apparently depended on, abscess in the brain, and where, to relieve the symptoms, he was obliged to plunge an abscess-lancet into the brain to evacuate pus, and from time to time to shave off the fungus as it rose above the surface of the brain, and the patient ultimately recovered. My own experience is in accordance with this. In all the cases I have had an opportunity of examining, I have found a cavity in the softened brain substance

corresponding to the base of the protrusion, containing broken-down disorganised clots and pus. I think it most probable that the extravasation at first, and subsequently the purulent collection, have been active agencies in causing the protrusion, by expanding the superjacent brain. As to the character of the protruded mass, I believe it varies in different cases. In all there will be found cerebral matter, but it varies in amount. In some, as those in which the dura mater has been torn, and the brain rapidly projected, the greatest part of the original protrusion consists of the cerebral substance, whilst in some, where the growth is more slow, and preceded by inflammation and ulceration of the dura mater, a very considerable part of the fungus may consist of fibrous structure, plastic lymph, and blood, with a smaller proportion of brain.

The state of a patient affected with fungus cerebri is always one of great danger; indeed recoveries are exceptional. Out of several cases in my own practice I have only met with one where the patient survived. In many cases the symptoms are not of a kind to excite alarm at first, but gradually irritability and excitement come on, with rigors, and then the patient becomes convulsed or paralysed, at last semi-comatose, and continues in that state till he dies. In cases where it follows severe injury, as in the case of gunshot wound, from which the sketch in plate XXVII. was taken, the patient, though he lives for a fortnight or longer, may never recover consciousness, and the fungoid protrusion apparently causes no alteration in his condition in any respect. In other cases the coma may become profound, and be accompanied by subsultus tendinum or convulsions and hemiplegia.

The method of treatment very generally adopted and recommended is the local application of pressure to repress the fungus, and general antiphlogistic regimen, and occasional anodynes, if there be much excitement. In the early part of my practice I gave this plan a fair trial, but I must say that I never saw it afford relief, and very generally it seemed to aggravate the symptoms, so that even the use of slight pressure could not be persisted in. I accordingly gave up the application of pressure in the early stage, and founding my practice upon the pathological conditions which I found in cases I had examined, and confirmed in my opinions by the views of Abernethy, and the experience of Mr. Hill and others, I had recourse to shaving off the fungus even below the level of the opening in the bone, which I was enabled to do, as the cases I had to deal with were openings caused by comminuted fracture, largely exposing the dura mater. In two or three cases distinct, though only temporary, benefit was afforded by the escape of pus and grumous blood, and the fungus was scarcely reproduced. In other cases the symptoms of coma were relieved, and the tendency to protrusion gradually lessened, though no matter seemed to escape; and I never have had any trouble from hæmorrhage or cerebral symptoms from cutting off the protrusion. After a time I use a thin fold of lint soaked with lime-water, or weak solution of tannin, and supported by a bandage or adhesive plaster, as a local application. Attention requires to be paid to diet; and although, as a general rule, antiphlogistic regimen is required at first, and stimulants

avoided for fear of exciting the circulation, yet after a time this must not be carried too far; and in many instances I have seen temporary benefit derived from the use of quinine and a rather liberal diet, when the patient perspires much and begins to be exhausted. After all, however, the very nature of the case gives but small chance of ultimate recovery. Here, as in many other diseases, our chance of success lies in prevention.

In cases of fracture, in which portions of bone have been removed, or in cases where the operation of trephining has been performed, I have long been in the habit of using a modification of the repressive treatment advised by Sir Charles Bell. His plan, as applied to the trepan opening, was to fold a piece of lint several times, and mark it with the crown of the trephine with which the opening had been made. The lint was then cut to the shape and size of the circle, and the compress, so prepared, was placed over and within the opening of the bone, and retained by a bandage, the object being to prevent the dura mater from being bulged into the aperture. Such a compress, however, gave rise to great irritation from direct pressure, and was unnecessarily powerful. After trephining, or removing fragments of fractured bone, the head having been previously shaved, I lay down the scalp close to the opening; and over the scalp and aperture I lay a portion of thin gutta-percha tissue. Over this I place a flat piece of sponge, larger than the opening, wrung out of boracic lotion, covering it with another layer of gutta-percha; the edges of the upper and under layers of the gutta-percha beyond the sponge are touched with chloroform, which makes them adhere, and then this light elastic compress is secured by a bandage or broad strip of adhesive plaster. This local treatment I have found most useful, as at once a clean and simple dressing, and as tending to repress the bulging upwards of the brain and dura mater against the margins of the aperture in the cranium. It should be combined with strict antiphlogistic treatment, purgation, and non-stimulating diet at first.

The operation of TREPAN or TREPHINING, strictly speaking, means the perforation of the cranium with the special instruments, the trepan or trephine; but the term Operation of Trepan, is now very generally used to denote all operations on the cranium having for their object its perforation—the elevation of depressed, or the removal of comminuted fragments of bone, whether performed with the trepan or other instruments.

The instruments required for the operation are not very numerous. The old trepan and trephining cases used to contain a great array of instruments, many of which are now never used; such were the rasparatory, for scraping off the pericranium; the perforator, for boring a hole to insert the centre-pin of the trephine, and the lenticular. The last-mentioned instrument, however, may occasionally be useful; at least I can conceive a case where it might smooth off an irregular edge, but I have never used it myself. Certainly it should not be used in every case to smooth the edge of the trephine wound, as used to be done, as that is likely to do harm by unnecessarily separating the dura mater by the button at the end of the instrument.

ments really necessary are—the trephines of different sizes, so arranged that they can be fitted to the handle of the trepan or trephine as required; trephine forceps fitted for removing the circle of bone cut by the trephine; an elevator; a “Hey’s saw;” bone-pliers; the lenticular; a small brush to clear the teeth of the trephine during the operation; a thin flat probe of wood, quill, or a silver toothpick, to examine the depth of different parts of the circle during the operation, and the usual apparatus of bistouries, sharp and probe pointed; dissecting and artery forceps, sponges, lint, etc.

The operation is modified by the nature of the causes requiring its performance, and as the simplest example of trepanning or trephining is perforation of the cranium for the purpose of evacuating blood or purulent matter, I shall first show you the method of procedure in such cases.

The operation consists essentially of three stages:—

1st. The incision of the scalp and pericranium.

2d. Section of the bone with the trepan or trephine.

3d. Evacuation of the extravasated blood or pus. In cases of depressed fracture, the third stage consists in elevating the depressed, and removing the loose fragments of bone.

In operating for evacuation of blood or pus, the line of our incision of the scalp will often be determined for us by some wound in that texture. If, however, there be no wound of the scalp, or only a small one, then, if the evacuation of purulent matter be the object, I make a free crucial incision through the puffy or boggy scalp, so as at once to expose the bone and to allow the unhealthy infiltrated pus to escape from the scalp texture. In the case of operation for extravasated blood, I prefer a V-shaped incision, the apex pointing downwards, as the flap adjusts itself more readily afterwards. In either case the vessels of the scalp which bleed should be secured before proceeding to the section of the bone. The size of the crown of the trephine, which is to be used for section, should be large, to facilitate the evacuation of the blood or pus. In the case of a fissure of the bone being discovered when we are trephining for extravasated blood, the centre pin of the trephine ought to be inserted close to the fissure, so as to make sure of including the line of the injured vessel, and to be able to secure it if possible after the evacuation of the coagula. When our object is to evacuate purulent matter, the crown of the trephine is placed over the denuded portion of bone, as that is most likely to correspond to the internal collection of pus.

The incision of the scalp having been made, I proceed to clear the bone for the saw; I divide the pericranium crucially, and then push it aside with the handle of the scalpel till I gain sufficient room to apply the trephine. Scraping off the pericranium, as used formerly to be done, is a most mischievous practice. The bone being now prepared for section, I apply the trephine; but you will observe that, before doing so, I project the centre pin, and fix it considerably beyond the line of the edge of the saw. I now press the centre pin firmly into the bone, and begin to work the trephine. When I remove the trephine, and find I have made a sufficiently deep groove to fix the saw, and

allow it to work in the circle, I withdraw the centre pin within the crown of the trephine, for, if this were neglected, it would perforate the bone before the circular saw, and so injure the dura mater. After brushing out the detritus of the bone from the teeth of the saw, I again resume the section of the bone; from time to time removing the trephine to clear its teeth, and also to ascertain the depth of section at different parts of the circle. In operating on the living you must proceed very deliberately, and that is one reason I prefer the trephine to the trepan, as the ease with which the latter is worked is very apt to make the operator careless, and lead to accidents. You will notice that I am now sawing with only one half of the circle of the trephine, and using the instrument unevenly as it were. The reason is, that I found with the quill probe that my section was much deeper at the upper segment of the circle than at the lower. The form of the cranium leads to this. Again, we must keep in mind the unequal thickness and hardness of the cranial bones, and carefully examine the section every now and then, and accommodate the pressure on the saw accordingly, elevating the teeth of the saw from that part of the circle where the section is deepest, and working more on those parts where the section is shallow. I now feel that the section is almost complete, and that if I used the trepan forceps or elevator I might remove it with a very little force, but that would leave an irregular margin, and might lead to irritation of the dura mater, so I continue to use the saw very lightly at the undivided part of the circle till I feel the bone loose, and then with the forceps I simply lift out the circle of bone. On the living, the blood or pus, if present between the bone and dura mater, would now be exposed, and the evacuation being effected, the scalp wound is closed, and dressed as I have recommended when speaking of fungus cerebri, or simply with tepid water lint laid over the part.

When the operation is required in cases of fracture of the cranium,



Fig. 161

our operative procedure is modified by the nature of the injury. In many cases the use of the trephine is not required. In largely comminuted fractures, for example, by getting out one fragment with the dissecting forceps, or raising an edge with the elevator, we gain room to elevate or extract other fragments. In other cases, by using the Hey's saw to cut across the base of some angular portion of the bone, which is sharply depressed, we are able to remove it, and thus gain room to enable us to deal with the other portions, as on examination may seem best (see plate XXVIII., figs. 2, 3, and 4). When we require to use the trephine in fracture of the skull, whilst the general principles regarding its use are the same as I have already described when operating for evacuating

for blood or pus, yet there are important modifications in its applica-

tion which we must attend to. In cases of depressed fracture, it is usually recommended to place the crown of the trephine on the sound bone, close to the depressed edge, as represented in fig. 161, so as to get the elevator introduced below the depressed edge, to raise it, using the sound unfissured margin of the trephine wound as the fulcrum for the lever. If the object in view in such cases was always and only elevation of the depressed edge, the principle would be correct enough; although even then we would frequently find that, owing to the depressed edge carrying along with it a shelving portion of the internal table from the undepressed part of the bone on which the trephine had been placed, we might not be able to introduce or use the elevator without a further section being made.

My own experience, in a very considerable number of cases in which I have operated, and others where I have assisted in operations for depressed and comminuted fractures of the skull, enables me to state that the removal of detached and depressed portions of bone is much more generally necessitated than mere elevation of the depressed margin, and hence our application of the trephine should be arranged so as to enable us to effect both objects with as little removal of sound bone as possible. In many instances we can effect this, as I shall show you, without using the trephine at all; but supposing that, as often happens, we must use the trephine to get sufficient room, then attention to the usual conditions of fractures requiring trepan, will, I think, indicate that the instrument may be applied with greater advantage at a different point from that usually advised. In almost every case in which there is a deep and abruptly depressed point or margin of the fractured cranium, it will be found that the bone is more or less fissured across the base of the depressed fragment. At the fissured part there is no shelving of the inner table, the bone is more or less completely cracked through in an even line; beyond the fissure the bone is perfectly sound and resistant. If the trephine be applied there, so as partly to overlap the fissured part, the sharp depressed fragment, with the shelving portion of the internal table, will be easily withdrawn, and other loose fragments removed, and any remaining depressed margins of the undetached parts of the bone can be as easily elevated. I have said that in many cases of comminuted fracture we do not require to remove a circle of bone with the trephine, but can effect our purpose without sacrificing any sound bone. I will show you what I mean by operating on this comminuted fracture made on the subject, which enables me to exemplify exactly what would be required in such an injury in the living. You notice the fracture is comminuted and depressed, but that fragments are closely impacted. I choose this large triangular fragment, knowing that its removal will give me room either to elevate the other depressed portions, or that, on its removal, these will be found loose, and be readily picked out. I now apply the cranial saw, known as Hey's saw, and with it, as you see, I saw across the base of the triangular piece of bone; next, with the dissecting forceps, or the thin point of the lever, I loosen it at the base, sides, and apex, and carefully remove it. This, you see, is a slow process, but now you perceive the effect. Most of the other fragments which were wedged in by it are now found to be loose,

and I lift them out, elevate readily the other depressed margins, and next examine for and pick out those small scales of the internal table lying on the dura mater; and all this is effected without removing any sound bone, and with the least possible disturbance of the parts.¹

In trephining in cases of punctured fracture, in which our chief object is to remove the depressed points and detached fragments of the internal table, corresponding to the puncture and radiating from it in all directions, I use a full-sized trephine, to permit of examination and easy extraction of the spicular portions of bone. To effect these objects, the puncture in the outer table of the skull should be the centre of the circle of bone to be removed. The objection to this, however, is, that to insert the centre pin of the trephine there would be very dangerous, but it is not necessary to use the centre pin. I take a piece of thin wood or moderately thick pasteboard or leather, and cut out a circular opening in it with the trephine I am about to use, and smooth the edges of the opening so made. I now place this over the part of the bone to be removed, the punctured wound of the bone being in the centre. The pasteboard is held firmly by an assistant until the trephine has made a sufficiently deep groove to work steadily in, and the section of the bone is then proceeded with as already described. In all cases of depressed fracture, but more especially in this form of injury, the trephine should be worked steadily and gently, without jerking, as otherwise any unsteady movement might cause the shelving portions of the internal table to impinge upon and puncture the dura mater, and even the brain itself. When the section is completed, the fragments—even the smallest—must be carefully picked out, and to make quite sure of removing all, without irritating too much the dura mater, I generally, after extracting the fragments that are visible, take a camel-hair pencil of large size, slightly wetted, and introduce it under the margins of the bone, so as to sweep off any scales or debris of bone which may be lodged there.

Finally, in this and all other forms of depressed fracture in which we operate, the state of the dura mater should be examined before closing the wound; and in all such cases the plan of dressing the wound I recommended when speaking of the prevention of fungus cerebri, should be employed at first, and indeed in most cases throughout the cure.

The general after-treatment may be stated as antiphlogistic. Opium or other anodynes may be given to procure rest. At one time opium was considered as improper in head injuries, but, after operation of trepan, if judiciously given, and its effects watched, it is often very beneficial. Ice to the head at first is of great use, both for modifying the circulation and as a sedative. In some cases, however, its effects are too depressing, and hence its action must be watched. In cases where we operate to evacuate purulent matter, the treatment must be modified in many cases. Nutrient diet and quinine, and even wine, are often necessary, and instead of doing harm prove of the greatest benefit. In fine, the state of the individual patient must regulate our practice.

¹ See Clinical Cases.

I have already stated, when speaking of the various injuries of the head, the circumstances which may require the surgeon to perform the operation of trepan, and the principles on which he acts in each case. But here, as in some other cases where emergency demands promptitude in action, I think it advisable, before leaving this important subject, to state succinctly, in a dogmatic form, the cases in which I would advise trepan to be performed :—

- 1st. *Without delay*, in all cases of distinct punctured fracture, to avert mischief by removing the fragments of the inner table.
- 2d. In cases of compound comminuted fracture, with depression (not in mere fissure, with wounded scalp).
- 3d. In simple depressed fracture, when, after a fair trial of other measures, the urgent symptoms of compression are persistent.
- 4th. In compression from extravasated blood, when the position of the injury or the existence of a fissured fracture indicate the probability of a large artery, such as the middle meningeal, having been torn.
- 5th. For intracranial suppuration, when the symptoms, and the existence of the puffy swelling, or unhealthy state of the scalp-wound and bone, give an indication of the probable position of the pus.
- 6th. In some cases of intracranial suppuration following contusion or fissure of the frontal bone in the vicinity of the supra-orbital ridge, in which the symptom of marked aphasia has been followed by coma, trephining may give relief, and save life, as in the case of M. K., mentioned in Clinical Cases; but although the aphasia preceding the coma gives an indication of the probable position of the pus, the diagnosis is always uncertain.¹
- 7th. In certain chronic cases, from disease or alteration in the bone following contusion or other injury, causing cerebral symptoms, such as local paralysis or epileptic fits.

This last rule is by no means so imperative as the others, and there is time for due consideration and consultation.

¹ See Clinical Cases; case of M. K.

LECTURE LXXXV.

INJURIES OF THE SPINE: Concussion of the Spine: Objective and Subjective Symptoms which characterise and accompany it; Indications of Treatment—Fractures and Dislocations of the Spine: their Diagnosis, Prognosis, and Treatment—Tumours of the Scalp: Cystic, Fibro-Plastic, Malignant, Vascular-Erectile; the Diagnosis and Treatment of each—Cirroid Aneurism or Arterial Varix—Necrosis of the Cranial Bones.

ALTHOUGH INJURIES OF THE SPINE may not be considered as belonging properly to the region of the head and neck, yet they are so similar in character to those of the head—the important feature being the implication of the nervous centres—that I think these injuries naturally come to be treated of in connection with each other. By doing so we will also save much needless repetition.

Like the brain, the spinal cord may suffer from concussion, without lesion of its substance, and from the effects induced by such injury. From compression caused by intraspinal extravasation, owing to laceration of vessels, in an injury causing concussion or fracture. From effusion, the result of inflammation of the spinal membranes after injury: or from direct and forcible compression, caused by displacement of the vertebræ in fractures, and dislocations of the spinal column. It is also liable to undergo softening and alteration in structure from inflammatory affections of a chronic type, following slowly on comparatively slight injuries.

The pathological conditions in concussion and compression of the spinal marrow are strictly analogous to those which we traced in these conditions in relation to the brain. The symptoms vary, however, in consequence of the difference in the functions of this part of the cerebro-spinal system, and hence they also differ according as the injury implicates different points of the spinal cord—the general symptoms being those of interrupted nervous power to the parts below the seat of injury.

From the anatomical arrangement of the spinal canal and its contents, the small size, form, and firmer consistence of the medulla spinalis, as compared with the brain, and from the arrangement of its membranes and vessels, especially the large size of the rachidian veins, it must, I think, be obvious, that if the medulla or its membranes suffer any direct lesion, its structure is likely to be implicated to a greater extent, and the bad effects produced are more likely to be permanent, or even progressive, than is the case in head injuries. Even injuries of the interspinous and other ligaments, may, from their close connection

with the lining membrane, be followed by chronic affections of the spinal marrow.

CONCUSSION OF THE SPINE may be caused in various ways, as by a person falling in the sitting posture, or backwards, and striking the back against some projecting body, or by a person being suddenly and forcibly projected forwards, and then suffering from the violent recoil, as frequently happens in railway accidents. The symptoms produced will be more or less loss of motion, or sensation, or both, in the parts below the injured point. If the concussion be severe, and has affected the spine high up in the cervical region, life may be at once extinguished. More generally, however, the result is loss of power of the extremities and sphincter muscles, together with difficult respiration and priapism.

If the case has been merely one of concussion, the symptoms after some hours begin to pass off and gradually disappear; and if the patient be kept quiet, lying on the side or in the prone position, and cold applied to the spine by means of ice-bags when reaction sets in, no bad consequences may follow, if only the patient be very cautious for a length of time not to exert himself in any way. In other cases, if, after the original symptoms disappear, loss of nervous power again manifests itself, preceded by pain or uneasiness in the back, leeches should be at once applied, and the bleeding promoted by fomenting with sponges wrung out of hot water. Subsequently cold should be applied to the spine as before, and absolute rest and non-stimulating diet strictly enforced. Great attention should be paid to the state of the bowels and urinary bladder.

The relapse of interrupted nervous function shortly after the original symptoms have passed off and reaction has occurred, points to intra-spinal extravasation as the cause. If pain and febrile symptoms occur at a later period, followed by the interrupted nervous function, inflammation of the membranes or of the cord itself is indicated. In this case, however, the interruption of the nervous power takes place more gradually than in the former, and is generally preceded by fever, hyperæsthesia, and painful cramps, or startings of the limbs. The general constitutional disturbance also is more marked, so that, besides the period of accession, the symptoms of the two conditions of extravasation and inflammation are sufficiently diagnostic. In some instances concussion of the spine may be followed by chronic forms of diseased action, affecting the medulla spinalis and its membranes, leading to gradually increasing paralytic symptoms. The progress of the alteration is very gradual, and so insidious as not at first to attract much attention; indeed, at first, the symptoms are mainly subjective, and so anomalous as often to be very similar to those of hypochondriasis or hysteria. If, however, any serious change in structure is commencing, certain marked symptoms supervene. The patient complains of a constant feeling of tightness and fulness at the lower part of the abdomen, and of slowness in passing urine. These symptoms he probably attributes to flatulence, which is generally present, and stricture of the urethra. Next, he feels peculiar creeping sensation (formication), prick-

ing and numbness in the extremities. He has cramps and jerking of the limbs when asleep, or about to fall asleep, and in some cases there is hyperæsthesia of the skin, especially in the lower limbs. After a time the patient walks awkwardly, sets down his feet irregularly, and lifts them high from the ground, and unless he is looking at his feet he is apt to stumble, or catch the point of his foot against slight inequalities. If we examine the patient at this time and desire him to shut his eyes and stand upright, away from any support, he begins to sway, and may even fall or stumble; and pressure on the injured part produces pain and starting of the limbs. After a time the paralytic condition becomes more marked, and the temperature of the affected limb or limbs is below the natural standard of the body. At this time the pulse and general constitution are affected, and the objective as well as subjective symptoms confirm the diagnosis.

I have said that even injury done to the ligamentous textures of the spinal column may be followed by such chronic changes as just described, in consequence of their close relation to and vascular connections with the membranes of the spinal cord, and a good deal has been made of this in regard to railway injuries; but it does not follow, because it *may* happen *occasionally*, that it is *likely* to happen as a *general rule*. If ordinary care and treatment be adopted, such results will be the rare exceptions, and when the symptoms do arise we can test how far they are really indicative of structural changes or due to an over-excited apprehension, a species of hysteria. We examine the urine whether it be alkaline or contain much phosphatic deposit,—note the temperature of the affected limb or limbs in relation to the natural standard and that of the rest of the body, the movements of the patient, and the state of the muscular tissue as to bulk and contractile power, if necessary by galvanising; and thus, by careful personal examination, and using these and other tests, we can form a correct opinion as to the state of the patient in any given case.

I have already indicated the treatment to be adopted in the case of spinal concussion, and that required to obviate the increase of intraspinal extravasation and inflammation following concussion. The slow alterations in structure are not so amenable to treatment, because, from the insidious manner in which they manifest themselves, before the patient becomes alarmed, considerable changes and degeneration in structure have probably taken place. The remedial measures consist of abstraction of blood by means of leeches, or cupping over the part with a view to relieve local congestion, in cases where the state of the pulse, febrile excitement, and painful jerkings of the limbs are present. In more chronic cases counter-irritation by blisters, the actual cautery, or other form of issue is indicated; and in all cases absolute rest is essential, if possible in the prone position, or the patient lying on his side rather than on his back. The constitutional treatment must be carried out on general principles, according to the state of the patient, and great attention must be paid to the condition of the urine, as there is always a tendency in it to become alkaline, and easily decomposed. Chronic cystitis is almost uniformly present in the later stages. The condition of the bowels also requires great attention. In

some chronic cases I have seen benefit derived from the exhibition of minute doses of strychnine. I generally prescribe it in solution, with the addition of dilute nitric acid, beginning with the $\frac{1}{30}$ th of a grain twice a day, never exceeding the $\frac{1}{15}$ th of a grain, and carefully watching its effects. By this treatment, and the use of the warm or tepid douche, and friction with the hand, and hair glove, the patients sometimes recover some amount of power. In some chronic cases marked benefit is derived from the use of baths, such as those of Wilbad, Tœplitz, Gastein, or Buxton. But, in general, these chronic affections, resulting from injury, are not satisfactory in their results.

FRACTURES AND DISLOCATIONS OF THE SPINE are, as you may readily conceive, after what I said regarding concussion, injuries in which the prognosis is always unfavourable, owing to the immediate and direct damage inflicted on the spinal cord by the fractured or displaced bones. Yet we sometimes meet with cases in which there is well-marked displacement or fracture, but where, from the manner in which the symptoms of paralysis pass away whilst the displacement of the bones remains unaltered, it is pretty evident that they were the effects of concussion, and not caused by the direct pressure of the displaced bone. (See case of John S——s, in Clinical Cases.) The occasional occurrence of distinct fracture, and displacement of the vertebræ, with little or only temporary disturbance of the functions of the spinal cord, may be accounted for by the flattened form and small size of the cord in relation to the cavity of the canal in which it lies. As a general rule, however, fracture or dislocation of the vertebræ is attended with complete or almost complete paralysis of the parts supplied by that part of the cord which is below the point of compression. Indeed, in most cases, from the secondary effects of the injury, diseased action, acute or chronic, affects the parts of the cord higher up, and so the loss of nervous power extends until at last complete paralysis takes place. If the injury be high up in the neck, death may result instantaneously, or the patient soon dies from interrupted respiration, depending on paralysis of the phrenic, thoracic, and intercostal nerves, or from the effect of the lesion being propagated to the medulla oblongata. In cases where the injury is lower down the fatal result is less rapid, and the patient dies, exhausted by low febrile action, cystitis, and bed sores, or from extension upwards of diseased action and degeneration of the medulla spinalis, the paralysis gradually extending, as already mentioned. In some cases, however, when the patient gets over the first effects of the injury, the symptoms improve, and although some deformity remains he gradually recovers, and the paralytic symptoms disappear. These successful cases should encourage us to use means, and not give up treatment as unavailing.

The *Treatment* to be adopted is similar to that for spinal concussion, only in most cases we require to place the patient on the back, and then the water-couch is almost essential to success. Attempts at reduction of the displaced bones are useless and dangerous, as being more likely to cause further injury to the cord than to replace the bones. Almost all displacements of the vertebræ are attended with fracture, as

the short and strong connecting ligaments do not readily permit of luxation, without fracture. It sometimes happens, however, that fracture of the spinous processes and laminae of one or more vertebrae may occur without displacement of their bodies in consequence of direct injury.

It has been proposed that in fracture or displacement of the vertebrae, giving rise to compression of the spinal cord, we should apply the trephine so as to remove the compressing cause; but as Mr. Liston has



Fig. 162.

well observed, "the spinal cord is generally displaced and compressed by the lower portion of the fractured body of the bones. One cannot easily comprehend what an operation is to effect in such cases." From my own observation of the state of the spinal marrow in fatal cases, I feel satisfied that in almost every instance the cord is not merely compressed, but its substance torn through or reduced to a pulp at the point of compression; and therefore, as its structure and functions are thus destroyed at the moment of the injury, removal of the compressing bone could not restore them. The only case in which the operation of trephining could possibly be of service, would be to elevate the broken fragments in a depressed fracture of the spinous processes and laminae of the vertebrae. But I

would not expect much benefit from the operation, and would not recommend or perform it. The patient will have a better chance of recovery by the treatment already advised, than if we add a fresh lesion and source of irritation to the existing injury.

Having now discussed the injuries of the scalp and cranium, it remains for me to speak very briefly of the diseases of that region. These are—tumours of the scalp, or those arising from the cranial bones; cirroid aneurism of the vessels of the scalp, naevi, or vascular erectile tumours; and cario-necrosis of the cranium.

TUMOURS OF THE SCALP are generally of the benign class, and the different forms of encysted tumour are by far the most common. The general characters of their growth I have formerly described. In this region they usually exist in numbers, scattered over the head, and varying in bulk from the size of a barley-corn to that of an orange. The cysts are thick and distinct from the scalp-texture, and so loosely connected that they are readily pulled out, unless pressure or wrong treatment has caused inflammatory adhesions between them and the surrounding tissues. If not interfered with, they may attain a large size, but if they inflame and suppurate, or give way, unhealthy action takes place, the scalp becomes thickened and irritable, the cyst of the tumour throws out fungous projections, and exudes a horribly foetid discharge, and the lymphatic glands at the back of the neck and ears

become painful and enlarged. Altogether, the case assumes an appearance of malignancy, and these cases are frequently spoken of as degeneration of a simple into a malignant growth. There is, however, no true malignancy. The tumour becomes irritable, and degenerates locally; but if the original tumour was a simple encysted one, there will be no constitutional taint, nor any contra-indication to its removal; and so soon as that is done, the enlarged lymphatics will disappear, and the wound heal and leave a healthy cicatrix.

The *Treatment* of encysted tumours in the scalp is in general very simple. If the growth be not larger than a small walnut, we transfix its base with a long narrow bistoury, and cut out, dividing the cyst and scalp, and then seizing the cyst with a pair of dissecting forceps, draw it from its loose cellular connections. In larger cysts, when we require to remove a portion of skin, or when we want to avoid opening the cyst to prevent its contents getting amongst the hair, we may cut upon the tumour, expose the cyst, and turn it out whole, with very great ease. In cases where the tumour has suppurated, the cyst may be partly adherent, and at other parts very friable, so that we cannot remove it as a whole. Then we remove as much as we can with the dissecting forceps, clear away the contents, and touch any adherent portions with nitrate of silver or other caustic, and apply warm-water dressing. In cases where we have removed the cyst entire in the usual way, we apply a compress over the part for a few hours, to prevent any blood distending the cavity in which the tumour lay. Afterwards little or no dressing or other treatment is required. I have said that we usually find a number of encysted tumours existing in different parts of the scalp. In some cases I have removed as many as ten or twelve at once, but I think it better to avoid removing so many at one operation, as a number of small wounds over the scalp may excite undue irritation, and I therefore seldom remove more than four or five of the larger growths at a time.

We sometimes meet with tumours which simulate cysts, but are of a very different nature, soft solid growths, medullary or medullary fibro-plastic. These should be recognised by the rapidity of their development, the general appearance of the patient, and the suspicious circumstance—in this region—that there is only one tumour. The treatment is early excision, before the lymphatics are affected. Some years ago I removed a soft medullary tumour, the size of a small orange, from the scalp of an old woman eighty-five years of age, who insisted on its removal, owing to the pain and rapid growth. Notwithstanding her age she made a good recovery. I saw her at different times for three years, during which time there was no recurrence of the growth, and, so far as I know, she may be alive yet.

Occasionally **SOFT MALIGNANT TUMOURS** of the cranial bones involving the scalp occur, and have, in their early stages, been unfortunately mistaken for wens. Operative interference in such cases is most disastrous in its results, for it hastens the progress of the growth, the removal of which is of course impossible. A less dangerous error I have known to be committed, is mistaking the swelling caused by a

small eburnated exostosis for a cyst. Such exostoses occur mostly in the frontal region, and between the bony growth and the scalp or skin there is usually a sort of bursal cyst. If this be opened, and attempts made to remove it, a very disagreeable and dangerous form of erysipelas is set up, and this risk to the patient might be avoided by a little care in examining into the history of the case and the character of the swelling.

VASCULAR ERECTILE TUMOURS or *nævi* are frequently met with, especially in children, both in the flattened and prominent form. The different methods of treating such growths have been already fully discussed. I may, however, state that recently I have resorted very generally to galvano-puncture, the continuous current being used, and have found it very effectual, without producing any undue irritation. Whatever procedure is adopted, I would give you this caution, that if the *nævus* be over or close to the fontanelle, we should allow that opening to be closed before resorting to any interference in young infants.

The condition termed CIRROID ANEURISM, or ARTERIAL VARIX, consists in a dilated and tortuous state of the arteries, which form pouches, anastomose with, and lead to enlargement of, the communicating vessels. It is most frequently met with in the lateral regions of the scalp, and over the temples, affecting the branches of the temporal, occipital, or posterior auricular arteries, and gives rise to a large pulsating tumour, on which the tortuous trunks of the vessels are seen. Pressure has occasionally been employed with success, to cause obliteration of the vessels. Deligation or compression of the trunks of the temporal or other affected arteries before they enter the tumour, has been the plan hitherto most resorted to. But in some cases of this disease, in which galvano-puncture has been methodically applied, the results have been so successful that I think it will probably be found to supersede other measures; or it may be combined with acupressure, to hasten the cure, and prevent all risk of embolism from displacement of portions of the clot. In all such cases, where galvano-puncture is used, pressure with the finger is maintained on the main trunks during the application, until consolidation of the clot has taken place.

NECROSIS, or CARIO-NECROSIS, with exfoliation of the cranial bones, has been already treated of as resulting from injury, or caused by specific forms of disease, such as syphilis or struma, or the effects of mercury. I need not therefore enter on the subject here, further than to point out that whilst the general rule in cases of necrosis—viz. to wait for the natural vital separation of exfoliations before attempting their removal—is applicable here as in other situations; yet, from the proximity of the diseased bone to the membranes of the brain, cases do occur in which, in consequence of cerebral irritation, it becomes necessary to interfere to remove the diseased bone earlier in order to get rid of an obvious source of irritation, and prevent the accumulation of purulent matter. Again, in many cases of cranial exfoliations, it

will be found that vital separation has really taken place, but the flattened surfaces adhere, and are retained by atmospheric pressure, and that on elevating one edge the whole exfoliation comes away with perfect ease. As to other local treatment, it consists in the application of red oxide of mercury, or dilute nitric acid, together with the use of charcoal poultices, to destroy any remaining vitality in the exfoliation, and hasten its separation from the healthier parts, followed by weak solutions of carbolic acid, or of the chlorides of zinc or soda, as lotions, to correct the factor and promote a gently stimulating effect on the surrounding tissues.

CLINICAL CASES

ILLUSTRATING INJURIES OF THE SCALP.

1. Anne G., æt. 48, was knocked down a flight of stairs, whereby the whole frontal bone was laid bare, and the flap, divided into two equal portions, reflected over the face. Silver sutures were used to keep the parts *in situ* after the bleeding vessels were secured. The hair was cut short. Cold applications to head, and the patient kept on low diet. Afterwards, abscesses formed in both eyelids, and bare bone could be felt through the openings which were made to evacuate the pus. The parts, however, cicatrised without any exfoliation taking place, and no other untoward symptom occurred to delay the cure.

2. Henry C——g, æt. 9, fell among some stones from a height of 12 feet, causing a wound near vertex, four inches long. Lips of wound brought together by two silver sutures, hair cut short, and cold to head. Patient was pale, cold, and trembling, on admission, but perfectly conscious. Pulse 80. Next day he became very feverish, complaining of pain in head. Stitches removed, purgatives administered, and two leeches behind ear. Four days after admission face was slightly erythematous. Cotton wadding applied, with the internal use of tinct. mur. ferri. With rest, low diet, and occasional purgatives, the cure was completed on the twentieth day.

3. David C., admitted 23d December. While in a state of intoxication he fell from the top of a loaded cart, and received a severe wound of the scalp. The incision extended from the left frontal eminence to the middle of the occiput. The scalp was detached from its connections, and turned down over the ear, leaving a considerable surface of bone exposed. A stream of tepid water was directed over the wound, to wash away the mud and filth. The edges were then brought into accurate apposition by silver sutures; the head was shaved, the bowels freely opened, and low diet enforced. Although this patient was an old man and a habitual drunkard, he recovered without an unfavourable symptom.

4. David Williamson, æt. 60, fell from a locomotive thrashing-machine, the wheel of which passed over his head. On admission, twenty-four hours after the accident, the scalp and pericranium were found to be detached from nearly the whole of left side of head, and the bone was extensively fissured. Pulse 74, and of good strength. Head was shaved, poultices applied over the whole of left side of the head, and an enema administered. Slight head symptoms, which yielded to leeches behind the ears and an occasional blister. Two large sequestra separated seven weeks after admission; the wound then rapidly healed, and the patient left cured.

Commentary.—The foregoing brief notices of the results of different forms of severe scalp wounds are given to illustrate the principles inculcated in the Lecture on that subject. Success in the treatment of scalp wounds depends greatly on their proper management at first. The wound ought to be carefully cleared of all filth by a stream of tepid water, the hair around it shaved, cold constantly applied to the head, the patient kept quiet in bed, put on low diet, and the bowels freely moved. If the skin has been reflected, it ought to be brought into position by points of silver suture. Sutures have been objected to as tending to produce great irritation, and the objectors either prefer compress and bandage, or leave nature to bring the parts into their proper site. Bad results will not arise from the use of silver, or even of thread sutures, if they are withdrawn on the first signs of irritation; whereas the employment of a compress and bandage implies the collection of the discharge, the frequent change of the dressing, and the infliction of a considerable amount of daily pain and mental excitement. Again, if the scalp is allowed to hang down, it becomes thickened and everted, the process of contraction is tedious, and the uncovered bone is very liable to exfoliate. The cases narrated were treated in accordance with the principles above laid down; and although the wounds were most extensive, the bone laid bare, and extensively fissured in some cases, and though one patient was an old drunkard, they went on most favourably.

CASES ILLUSTRATIVE OF PASSIVE INTRACRANIAL HÆMORRHAGE FOLLOWING CONCUSSION.

1. Mr. —, aged 24, fell from the back of a carriage whilst it was in rapid motion. He felt stunned for a few minutes, but recovered, was able to take a glass of water, and thereafter proceeded in the carriage to town. He felt, he said, quite well, but as his head was cut, he requested to be left at a friend's house that night, so as not to alarm his own family, and he walked without any difficulty to the house, some distance from where the carriage stopped. Next morning he awoke with a violent headache, and complained of noise in the head, but after a short time he again felt better. I was asked to see him, and visited him on the third day after the accident. He told me he had another attack of headache, accompanied with the same sensation of a "rushing noise" in the head, as on the morning after the accident. Of the fall, he spoke as having been slight, and that he never had been unconscious, only stunned. At the time of my visit he felt little or no uneasiness in the head; his pulse (usually 76) was 70, and soft; he had taken some saline medicine, which had acted freely on his bowels, and he made light of his injury. The only disagreeable feeling he now had, he said, was occasional black spots before his eyes, which he attributed to indigestion. I ordered that eight leeches should be applied behind the ears, cold to the head, and enjoined absolute rest. I also prescribed a solution of tartarised antimony (1-16th of a grain) every fourth hour.

Next day he was much better, had had no return of the headache; felt lighter, as he expressed it, and wanted to get up, and go home. I, however, persuaded him to remain quiet, and continue the treatment and antiphlogistic regimen; his pulse at this time never rose above 70, and was soft in character.

He continued to go on favourably for the next six days, only very desirous to get up and go out. On the sixth day after the accident, as both he and his friends were urgent to have him removed home, I had him carefully removed in a carriage, with as little motion as possible. Notwithstanding every precaution, however, and though the distance he had to be conveyed was not great, violent headache, with the same rushing sensation in the head, occurred during the transit, and continued when he was placed in bed. After he had rested for some time I felt his pulse, and found it was barely 60 beats per minute, and laboured. I at once ordered twelve leeches to be applied behind the ears, and cold cloths constantly kept to his head, and hot bottles to his feet. Under this treatment the headache and uneasy feeling and noise in the head passed off, and he again felt well. The pulse, however, never rose above 60, and the pupils contracted sluggishly; in other respects he said he felt quite well, and two days afterwards he was anxious to be up, and could hardly be persuaded to remain in bed. On the eleventh day from the accident he did not feel so well, complained of aching pain, and return of the sensation of rushing noise in his head. He had a somewhat anxious expression, though, at the period of my visit, the pain in the head had passed off; his pulse had now fallen to 56, and his pupils contracted very sluggishly. In the evening he was flushed and excited, but the pulse was still slow. He passed a very restless night, starting, and speaking through his sleep. He had a dose of henbane, which quieted him and procured him some sleep. Next morning he looked pale and haggard, and though still excited in manner, his pulse was 54 and laboured, his pupils largely dilated, and sluggish in contraction when tested by the light of a taper. I ordered a blister to the nape of the neck, and an enema to act on the bowels; and as he was restless, with a tendency to wandering and delirium, he was constantly watched. Throughout the day he was quieter, and said he was free from pain. In the evening I found him again flushed and excited, and complaining of pain, but his expressions were incoherent. I remained with him for some hours during the first part of the night; about midnight he became delirious and somewhat violent, but recognised me and lay quiet when I spoke to him; by and by he fell asleep, and I left him. All next day he continued in a delirious state, but seemed relieved by the action of the blister. I again watched with him during the evening, and as he seemed quieter and inclined to sleep, I left about midnight. At 4 A.M. I was summoned to see him. He had awoke about 2 A.M., as from a dream, in a state of violent delirium, and tried to get out of bed, when, in an attempt to do so, he suddenly became convulsed and unconscious. When I reached his house he had so far recovered consciousness, but was incoherent and restless. His features were distorted as from paralysis, and there was strabismus; his pulse was about 50. Cold was applied to the head, and flannels, wrung out of warm water in which mustard had been diffused, were wrapped round his feet and legs. He had passed his feces and urine involuntarily during the convulsion. After a time he became quieter, but I remained in the house. In the morning he had another slight convulsion, after which he passed into a state of profound coma, with stertorous breathing, dilated pupils, and all the symptoms of compression of the brain. He died on the morning of the fifteenth day after the accident. The *post-mortem* examination revealed an enormous mass of blood effused over the left hemisphere of the brain, between the bone and dura mater, and also in the occipital region. The greater part of the coagulum was soft and recent, whilst other and smaller portions were of different degrees of solidity, some portions being very firm. The blood seemed to have escaped from the rupture of one of the small petrosal sinuses, where it entered the lateral sinus. There was

no laceration or other lesion of the brain substance, but there was considerable subarachnoid effusion of a plastic character.

2. Mr. —, aged 21. In driving a gig down a steep hill near Edinburgh, the horse ran off, and he was pitched out with great force, and was lifted up quite insensible and cold. He was brought into town, and I saw him on the forenoon of the next day. I was informed that the state of concussion had lasted for some hours, after which he became conscious. He then vomited and complained of headache. When I visited him reaction had set in; his skin was warm, his pulse 72, and he had only slight headache. I ordered the head to be shaved over the bruised part, and cold to be applied to the head, and an enema to be given. On my visit in the afternoon I found that the bowels had acted freely after the enema, but he complained of a dull heavy headache, and a noise "like waves" in the head. On examining the pupils they were dilated, and only contracted very slowly under the stimulus of light. His pulse had fallen to 58 beats in the minute, and his breathing seemed oppressed. I at once bled him from the arm to the extent of 14 ounces. He expressed himself much relieved of the headache, and breathed more easily; and his pulse rose to 76 after the bleeding. I now had the whole head shaved, and iced water cloths constantly applied to his head. I ordered very minute doses of antimony every three hours, and enjoined absolute quietude and low diet. At my visit next day he was somewhat sick from the antimony, but had no headache or uneasiness. His pulse was 70. In the evening he had a slight headache, and his pulse had fallen to 66. I ordered four leeches to be applied behind the ear. In the morning he said the headache had been relieved by the leeches; but that shortly before I came, after getting up to stool, he felt the sounding in the head, and some pain. His pulse at this time was 70. I ordered the cold to the head to be continued, and warned him against getting out of bed on any account. In the afternoon his headache had increased, the pupils were dilated and sluggish, and his pulse had fallen to 58. I again bled him from the arm to the extent of 10 ounces, and desired the cold and other treatment to be continued. From this time he went on favourably till the fourteenth day, when he had some return of the symptoms. These yielded, however, to the effects of a blister to the nape of the neck, and free purgation; and he left town quite recovered at the end of a month.

CASES OF INTRACRANIAL SUPPURATION.

1. Christina S—n, æt. 36, on the 28th January 1860, was struck on the head by a quantity of hard lime and brick thrown from a house-top three storeys high. She was rendered insensible for some time, and lost a considerable quantity of blood from a wound two inches long, situated over the middle of the superior part of os frontis. Admitted February 7, 1860. Patient staggers as she walks; is dull and listless; complains of severe pain around wound, the edges of which are pale brown and everted; nearly two inches of frontal bone can be felt bare. Has had repeated rigors since third day after the accident; vomits continually; pupils dilated and sluggish; pulse 60. Ordered aperients, and blister behind ear. No improvement following this treatment, Mr. Spence trephined at the seat of the injury. Only a little matter was found; but immediately after the operation the pulse rose to 66, and vomiting only occurred once afterwards, while the rigors never returned. Headache continuing, a seton was introduced; and on the 25th April 1860 the patient left, cured.

2. James B——r, æt. 28, fell on the 28th April 1860, and was admitted into the hospital 7th May 1860. Over occiput a scalp wound existed, whose edges were swollen, puffy, pale brown, and everted. The bone was entirely denuded of periosteum. He had headache, dimness of vision, and singing noises in the ears. Ordered rest, low diet, purgatives, and leeches. On the 13th an abscess below the wound was opened. On the evening of the 18th he was seized with rigors and vomiting. A blister applied to nape of neck, head to be shaved, and mustard cataplasms to epigastrium. The rigors and vomiting, with high pulse and occipital pain, continued unabated until the 19th, when delirium, and then coma, set in. Patient died on the 22d, at noon. His friends would not allow trephining to be performed.

Post-mortem.—May 24th. Membranes generally adherent. Beneath necrosed occiput a quantity of purulent matter was found. Dura mater at same place sloughy, but entire. From occiput a fissured fracture extended downwards, forwards, and upwards, terminating at the post-clinoid process. No pus was found between the membranes and brain, nor in the brain-substance itself.

Commentary.—The case of Christina S——n illustrates the amount of disturbance which may be caused by a very small amount of purulent matter, and dead or dying bone. Before her admission into hospital, ten days after the injury, she had had intense headache, want of sleep, vomiting, and repeated rigors, and, for some days before admission, imperfect power of controlling the movements of her limbs. Notwithstanding all remedial measures used after she was received into the hospital, the bad symptoms increased. She screamed with pain; at the same time a kind of semi-consciousness as to surrounding objects developed itself, and there was limited facial paralysis. The wound of the scalp was unhealthy, and scalp around boggy and swollen, whilst the exposed bone was dry and bare. Under these circumstances trepan was performed; and although only a very little unhealthy pus was found, yet her recovery went on without interruption from the time of the operation. I cannot help concluding that removal of the dead bone and small quantity of pus, as sources of irritation, and the relief of tension, proved the means of saving this woman's life, judging from the progress of the symptoms prior and subsequent to the operation.

In the case of B——r, though the dangerous symptoms were somewhat slow in manifesting themselves, yet the unhealthy state of the scalp wound, and the denuded bone, in conjunction with headaches, gave rise to an unfavourable prognosis; and when the more urgent symptoms supervened, combined with the formation of a boggy swelling, which, when opened, exposed a further portion of bare bone, I felt no hesitation in recommending trephining. This, however, was not permitted, and the patient died comatose. From the *post-mortem* appearances I still think that the operation was advisable, as affording a chance of relief. The existence of the fissure of the base could not be determined during life; and, moreover, as it was attended with no displacement, and as the only place where the dura mater was diseased was at the point corresponding to the puffy swelling and necrosed bone, I cannot consider such fissure as in itself a contra-indication, especially if we view it in connection with the successful result of some other cases of severe fracture at the base which I have recorded.

CASE OF SEVERE CONTUSION OF FRONTAL BONE—MARKED CEREBRAL SYMPTOMS—TREPHINING OF SKULL—INTRACRANIAL SUPPURATION—RECOVERY.

M. K., *æt.* 22. Admitted January 2, 1881. On admission a scalp wound of the left frontal eminence was found. This was about two inches in length, and passed down to the bone, which was denuded of periosteum to the extent of about a crown piece. He had been struck by a hammer, but the symptoms of concussion had passed off before admission.

Till the tenth day he progressed favourably, and was anxious to leave the hospital. On the evening of this day he was seized with slight but constant shivering, and complained of severe occipital headache. The temperature rose to 100° from normal; pulse 80.

January 15th.—Delirious during the night. Temperature fluctuating; at one time 103°.

January 16th.—Continues delirious; has occasional squinting; voids his urine unconsciously. He has lost the power of articulating words, and can only utter a peculiar whining cry when addressed. Temperature, 101°; morning pulse, 128; evening, 52.

January 17th.—Temperature, 100°; pulse, 50. He is more composed, and able to speak, but has distinct paresis of the right arm. It was now thought advisable to trephine at the seat of the injury, and Professor Spence accordingly did so, removing a portion of bone about the size of a shilling. This was found to be in an inflammatory condition, the internal table presenting a rough granular surface, and being slightly adherent to the dura mater. The deploe of the circle removed was slightly infiltrated with pus. Between the inner table of the skull and dura mater there was a thick layer of plastic material. On incising the dura mater about a teaspoonful of pus escaped, welling up from the direction of the fissure of Sylvius. In the evening his temperature was 100°; pulse 72.

January 18th.—Patient is conscious, but partial aphasia and paresis of the right arm remain. On changing the dressings it was found that no further discharge of pus had taken place. Temperature, 100°. In the evening the pulse rose to 72 from 54, the morning rate.

January 19th.—Again restless and delirious; aphasia more pronounced.

January 25th.—Patient is improving; is more composed. Can answer "yes" and "no" on being questioned.

January 27th.—Speech returning, and also power to right arm.

February 8th.—There is a sudden and marked improvement in his mental condition.

February 9th.—Antiseptic dressings are now discontinued.

February 24th.—An annular piece of necrosed bone, being the margin of the opening made by the trephine wound was extracted from the wound.

From this date the progress of the patient towards recovery was most satisfactory. A metal plate with a spring was fitted to protect the part operated on. He left the hospital cured on the 7th April.

Remarks.—The case of M. K. is an exceptional one as regards operative interference in cases of intracranial suppuration. I was satisfied from the appearance of the wound and the surrounding scalp that there was no indication of pus being situated between the bone

and dura mater, and all the symptoms pointed to the presence of pus or other inflammatory products in the arachnoid space, or alteration in the brain itself, and these conditions, as I have pointed out in the Lectures, are not usually favourable for trephining. The warrant for operating in this case was the marked aphasia localising the position of the mischief, and the consideration that the contusion of the frontal bone might have led to fissure of its orbital plate, or inflammation of the membranes covering that plate, and that therefore the pus would probably be situated at or in front of the Sylvian fissure, and that if it were so the operation might afford relief, whilst otherwise the case was hopeless. In this case the operation fortunately did give relief. But in another case on which I operated recently, where the symptoms were similar, and the condition of aphasia also present, no purulent matter escaped, and no relief was afforded. Examination after death disclosed extensive suppuration, meningitis over both frontal lobes, especially in the first frontal convolutions, and purulent effusion around both Sylvian fissures.

The lateral ventricles were distended with fluid in the posterior cornua. Some purulent matter was found. Between the lower surface of cerebellum and corpora quadrigemina an abscess-like collection of pus existed. I was not myself present at the autopsy, but I understand the purulent meningitis was rather a layer of creamy pus on the surface of the arachnoid than a collection of ordinary fluid pus. Indeed, after trephining and incising the dura mater, when no matter escaped, I passed a small soft bulbous-pointed catheter gently along the orbital plate of the frontal bone, and no pus followed its withdrawal.

The two cases as regards symptoms were somewhat similar, but results show the uncertainty in such cases.

CASE OF FRACTURE OF THE CRANIUM.

Arthur M'Kenzie fell from a ladder whilst at work, and alighted on his head. He was taken up insensible, and immediately brought to the hospital. He was in a state of complete collapse—face pale, extremities cold, pulse scarcely perceptible. A large fluctuating tumour was observed over the left parietal bone, and a sharp raised margin felt at some parts of the circumference of the tumour. Head was shaved, heat applied to the surface of the body, and a little brandy administered. Towards evening the pulse rose to 100, and was stronger; breathing long, loud, but not stertorous; pupils dilated, and insensible to light; patient once or twice spoke, and complained of pain. Six leeches were applied behind the ears, and cold to the head. Under the repeated application of leeches, and the use of free purgation, patient rapidly improved. Ten days after admission, as the pulse again rose, a seton was introduced at nape of neck. The tumour now began to disappear rapidly, and an evaporating lotion was applied. Severity of head symptoms soon abated. At the end of four weeks the depression could scarcely be detected, and at the end of two months the patient was dismissed cured.

CASES OF COMPOUND COMMINUTED FRACTURE OF THE CRANIUM.

1. J. H., plumber, was brought to the Infirmary at 3 P.M., August 1, having a short time before fallen from a considerable height in the National Bank. On admission he was nearly insensible, his skin cold, breathing low, and pulse 70, very feeble. There was a wound two inches long on the back part of the head, towards the left side, communicating with a depressed comminuted fracture of the skull. There was fracture of the right leg and of the middle metacarpal bone of the left hand, and a superficial wound on the left arm. He vomited considerably while being placed in bed. Hot bottles were applied all round his body.

At 4 P.M. Mr. Spence applied the trephine, and removed the depressed portion of bone. It was then observed that the dura mater was injured at one point, and the cerebral matter could be distinctly felt projecting. There was immediate improvement in the patient's condition. He became more sensible; his pulse rose to 80; his breathing became more natural; but his face was noticed to be twisted to the right side. Next day he complained of intense headache; his face was flushed; pulse 90. Six leeches were applied behind the left ear, and they were repeated in the evening, giving great relief.—On the 4th his pulse was still 90; headache present, but not so intense. Leeches were again applied.

On the 7th the wound began to suppurate, the pulse fell to 70, and the headache disappeared. From this time the patient progressed favourably, his cure being retarded by cynanche tonsillaris, from which he suffered severely during the last week of August. He is now quite well.

2. Thomas Porter, *æt.* 22, was kicked by a horse on the head, and was immediately brought to the hospital, when there was found to be a scalp wound about half-an-inch in front of the posterior superior angle of the left parietal bone, three-quarters of an inch to the left of the longitudinal sinus. On introduction of the finger, a considerable depression of bone was detected, a portion being driven in and impacted. His pulse was of a good strength, and up to that time he had suffered from no head symptoms. He was put under the influence of chloroform, and the operation for trephining resorted to. Several impacted portions of bone were removed; the dura mater was seemingly intact, except at one point. There was considerable venous hæmorrhage, which, however, soon ceased. One or two silver sutures introduced to keep flaps of skin in contact, the head shaved, and cold applied. On the following day his bowels were fully opened by means of jalap and calomel, and he was apparently going on favourably, till the evening of the fifth day, when his pulse rose from 85 to 140, and he began to complain of considerable pain in the head. Six leeches were applied behind the ears, and a saline aperient administered. Following day feverish symptoms still continuing, a blister was applied to nape of neck. Pupils slightly dilated, but readily contract on application of light. On the seventh day there was a distinct rigor; wound looking healthy. Complained of complete loss of power of the right side on the ninth day. Head symptoms more intense; ordered small doses of calomel: portion of dura mater now began to look sloughy; patient became rapidly worse; pulse ranging from 130 to 140; answered questions incoherently; was very violent at times; breathing stertorous; and died comatose on the thirteenth day.

Post-mortem appearance.—Dura mater sloughy at parts; pus effused over the surface of the brain, and an abscess at base of brain on left side.

3. J. T., while following a runaway horse, received a kick on the forehead. He had been drinking previously to the accident, and when admitted to the hospital, half-an-hour afterwards, was in a somewhat excited state, and his pupils were dilated. There was a compound fracture, with depression a little above the right superciliary ridge. Mr. Spence, being sent for, immediately trephined, and found much splintering of the inner table, with slight abrasion of the dura mater. The head was ordered to be shaved and cold applied, while low diet and perfect quietness were enjoined. For six days after the operation the patient progressed most favourably. The wound looked well; there was no headache or flushing of the face, and his pulse averaged 72. On the 7th day, after a restless night, his pulse rose to 86. He was ordered six leeches behind the ears, antimony in doses of a twentieth of a grain, and a saline aperient. Feverish symptoms continued to increase in severity during the two following days. He complained of intense headache; his pupils were dilated, and there was a wild expression of countenance, with slight delirium. On the 10th day the pulse fell to 40, and after several violent convulsive seizures he died comatose. After death there was found to be pus infiltrated into the meshes of the pia mater all over the surface of the brain.

4. A. P., aged 17, residing at Walltower, near Penicuik. Whilst engaged with some of his fellow-workmen at a game of quoits, he stepped forward to mark the position of the quoits, thinking all had been thrown. Just as he was stooping he was struck on the left side of the head; he felt the blow and was stunned, but not rendered insensible. He was conveyed home, and seen by Dr. Fauchie, who found he had suffered a compound fracture of the cranium. I was sent for, and saw the patient a few hours after the accident. He was then in bed, conscious but restless, moaning, and suffering from pain in the head. His pulse was slow and full, pupils were dilated, but contracted slowly under the stimulus of light. On examination I found a large scalp wound, with depressed and somewhat ragged margins; on raising these, and introducing my finger, I felt that the left parietal bone, about two inches above the squamous suture, was fractured, comminuted, and depressed, and a portion driven inwards and downwards under the lower edge of the fracture. I accordingly, after bringing the patient under the influence of chloroform, proceeded to apply the trephine, which enabled me to remove many fragments; but the large shelving portion was so impacted that I removed a projecting corner of bone with Hey's saw to gain room, so as to avoid risk to the dura mater in extracting it. I then lifted it out easily, and also several other smaller portions which were then exposed. The dura mater had been shaken from the bone for some distance, but so far as I could see or feel that membrane seemed to have escaped laceration or puncture. The wound was then dressed, and the patient replaced in bed. From the time of the operation he went on so favourably that I did not require to see him, and he was allowed to go out at the end of six weeks. The operation was performed in September 1868, and when I saw him last, in August 1870, he said he had never suffered any inconvenience, and that he could follow his business, that of a joiner, which requires him to ascend considerable elevations, without any giddiness. The opening left by the injury and trephine wound, which was large, had apparently filled up almost, if not altogether, by a thin firm osseous plate, a result which is unusual in my experience of such cases.

COMPOUND COMMINUTED FRACTURE OF CRANIUM, WITH WOUND
OF THE LONGITUDINAL SINUS.

G. B., a young, stout, and healthy cabman, was admitted on the 29th January. When standing on the pavement of the High Street a brick fell from the roof of a house, and inflicted a very severe compound comminuted fracture of the cranium. By the injury he was rendered a little giddy, but not insensible. On admission, the general symptoms were far from being alarming; the pulse was 72, and natural; the pupils equal and contractile; the skin warm; and the respiration normal. The fracture was situated over the posterior extremity of the sagittal suture, and extended about an inch transversely and longitudinally. It was accompanied with marked central depression. There had been a slight amount of hæmorrhage, but it had almost entirely ceased. Chloroform was administered, and the incision in the scalp extended. A small fragment of bone, which was completely detached, was removed, and the bone-pliers were introduced through the opening, so as to divide the denuded and depressed pieces, and allow of their being either elevated or withdrawn. The inner plate was found to have been splintered. The smaller fragments were easily taken away; but one large, shelving portion had to be divided by the pliers previous to removal. As this latter spicula had been driven into the longitudinal sinus, a gush of blood followed its withdrawal. The jet was easily checked by the pressure of a finger until the wound was thoroughly searched, and all loose particles removed. A small piece of lint was then placed directly over the wound in the sinus, and above it larger pieces, until the whole space was lightly filled. This sufficed to check the hæmorrhage. The patient was replaced in bed, and iced water kept constantly applied to the head. Next day all the pads were removed except the one in direct contact with the bloodvessel. In the evening a saline purge was given; and as the pulse had risen from 84 to 100, he was put on small doses of tartar-emetic. On the third day a small fragment of bone, which pressed directly inwards on the brain, was removed by the pliers. During the third and fourth days, the pulse varied from 80 to 88; the mental faculties were unaffected; and the general appearance of the patient augured well. On the sixth day, however, he had slight rigors, and the pulse rose to 112. Leeches were placed behind the ears; and on the seventh day the pulse numbered 92. In consequence of the pulse rising to 100 towards the evening, a blister was applied between the shoulders. On the morning of the eighth day he wandered, the rigors and sweats were repeated; in the afternoon he became comatose, with paralysis of the left arm and leg, and marked dilatation of the pupils. The coma gradually deepened, and he died on the evening of the ninth day after receipt of the injury. On examination, the bone around the wound was smooth and healthy, but underneath the dura mater a diffuse collection of pus covered the right side and base of the brain. A small abscess was found in the posterior lobe. The longitudinal sinus was completely occluded by a large fibrinous clot.

GUNSHOT FRACTURE OF CRANIUM.

A. B., æt. 21, was brought to the hospital on *October 2d*, at 9.30 P.M., with a severe compound comminuted fracture of the skull, which had been caused by the discharge of a fowling-piece. The fracture involved the left

parietal and frontal bones, and was situated about midway between the anterior termination of the sagittal suture and the anterior inferior angle of the parietal bone. The wound of the integuments was much lacerated, and several pieces of the splintered bone were depressed. Mr. Spence, who was at once summoned to the case, removed in all fifteen detached fragments of bone, and elevated any remaining portions which were depressed. The dura mater was found intact, except at one point, where there was a small laceration. The patient, who was now placed in bed, after having had his head shaved and cold applied, seemed to be in some degree conscious of what was going on, and to understand questions addressed to him, though unable to answer them. The pulse, which, though weak, was about the natural standard after the operation, about three o'clock next morning became strong and full, and rose to 88; and as the patient was feverish and restless, he was ordered antimony in doses of a twentieth of a grain. During the day he vomited twice; the pulse varied from 80 to 54. He was ordered six leeches behind the left ear, and an enema, which moved his bowels freely. On the morning of the 4th, after a tolerably quiet night, the wound was looking well, but the pulse, which was about 66, was irregular, and there was slight paralysis of the right side. On the evening of 5th, six leeches were again ordered to be applied to the mastoid region, in consequence of the pulse having fallen to about 50. 6th.—Pulse 60; urine, hitherto passed in bed, drawn off by a catheter; ordered a castor-oil enema. 7th.—Patient has passed a good night, and seems more intelligent, but is still unable to make water. Convulsions, however, came on in the afternoon, chiefly affecting the paralysed side, and there was considerable hæmorrhage from the wound, through which the brain-substance had begun to protrude. 8th.—Has had two more convulsive seizures; pulse 67, regular; blister ordered to the nape of the neck. About 3 P.M. there was renewed hæmorrhage from the wound, which was arrested by transfixing the bleeding point and securing it by a ligature; pulse 86, regular, but weak and compressible. 9th.—Hæmorrhage again occurred, and could not be stanchied till a slough had been removed. 12th.—For the last two days the fungus cerebri has been rapidly increasing, and is now about the size of the closed fist. Patient somewhat restless, but intelligence still improving; has passed water voluntarily for the last three days; pulse 100. 15th.—Since last report, the patient has been progressing favourably, but to-day he has had repeated rigors, and been very restless and noisy. Part of the fungus has separated; the bowels have been freely moved by an enema; pulse 106. 16th.—Patient looks much worse; has passed a very bad night. Recurring hæmorrhage from the surface of the fungus and edges of the wound, arrested by matico; pulse 100. Early next morning symptoms of coma gradually set in, and patient died about 4 A.M. On *post-mortem* examination, an abscess was found diffused through the left cerebral hemisphere, the surface of which was covered with a layer of pus most distinct towards the base.

Remarks.—The case of Arthur M'Kenzie was one of simple fracture of the cranium, with depression; but the dangerous symptoms were evidently those of severe concussion, not compression. The depression of the cranium was pretty extensive as to surface, but not in depth; and the state of the pulse, pupils, and breathing, as well as the subsequent progress of the case, showed that the symptoms were not due to the depression of the bone. I think it well to notice this, as there is often a tendency, when such injury exists with symptoms of uncon-

sciousness, to regard the fracture as the cause, and to resort to operative measures to remove the depression. This case, with many similar which I have seen, shows the necessity for carefully examining the general symptoms; and—if they be those of concussion—of refraining from operative interference with the depressed bone, but resorting to other treatment. Indeed, even when the symptoms are those of compression, when the fracture is simple, I consider it the wisest plan not to interfere unless the symptoms do not yield to depletion, purging, and other general remedies; for, in a great number of cases, such general treatment is successful.

The cases of compound fracture of the skull stand out in strong contrast to the last case, as regards the propriety, or rather the necessity, for operative interference. In cases of compound fractures, especially in such as those detailed, in which the injury has been inflicted by great and direct force, and where, through the wounded scalp, we can see or feel that the bone is depressed and comminuted, there can, in my opinion, be no possible reason for delaying the removal of the shattered fragments, and elevating the larger depressed portions. By operating here we superadd no danger. We do not convert a simple into a compound fracture, whilst we remove the detached spicular fragments, which, if they did not directly puncture the membranes, must ultimately, as foreign or dead portions, infallibly lead to inflammation and suppuration within the cranium. In such cases, to wait for urgent symptoms as our warrant to operate, is to wait till the operation is of little use. It was this conviction, founded on former experience, that led me at once to operate in the cases of Porter and J. T. Unfortunately, a sharp-pointed portion of the depressed bone had injured the dura mater, and this, I doubt not, led to the meningitis which proved fatal; but the numerous detached fragments removed showed the absolute necessity for interference. The venous bleeding referred to in the report of Porter's case followed the removal of a shelving portion of the inner table which had been driven up towards the sagittal suture; and I think there could be little doubt that the fragment must have punctured the longitudinal sinus, so that its withdrawal was followed by smart venous hæmorrhage, which, however, was soon stopped by very slight pressure.

The case of A. B. was one of very severe and extensive compound comminuted gunshot fracture; and when we consider the lacerated state of the scalp, and the extreme splintering of the skull, there can be little question of the propriety of removing the shattered and isolated fragments of bone. Even in the absence of any marked symptoms of compression, operative interference was not only justifiable but urgently called for, as the presence of broken pieces of bone, severed from all vital connection, would, by their irritation of the membranes and their certain necrosis, have undoubtedly been attended by greater risk to the patient. The paralysis, convulsions, and other nervous symptoms, together with the *hernia cerebri* which subsequently took place, cannot be considered as having been influenced by the operation, for they were no doubt due to sloughing of the membranes, and to inflammation and suppuration within the cranium, following the lacer-

ation of the dura mater and contusion of the brain-substance, which took place at the time of the accident. As in this case, true hernia cerebri seems always to be accompanied by abscess of the cerebral matter, and to be the result of increased volume due to the presence of the products of inflammation. Though there was great danger from the recurring hæmorrhage, death was caused not by the hernia cerebri, but by the morbid processes going on within the cranium, of which the hernia cerebri was the result.

CASE OF DEPRESSED FRACTURE OF CRANIUM. OPERATION OF TREPHINING EIGHT DAYS AFTER ACCIDENT—RECOVERY.

Wm. S., æt. 29 years, railway porter, admitted into Royal Infirmary Nov. 22d, 1873.—On the day of his admission the patient received a blow on outer side of left eye, from the handle of a crane, which rendered him perfectly unconscious at the time, but on his arrival at hospital he had partly recovered consciousness.

On examination a cut $\frac{3}{4}$ of an inch in length parallel to the outer part of the superciliary ridge was found. There was also considerable swelling. Tepid water dressing was applied. Milk and beef-tea diet ordered.

Nov. 23d.—The pulse and temp. were normal, but they gradually began to rise, until, on 26th, the temp. was 102°2. Urine slightly albuminous.

Left eyeball protruded, owing to extravasation of blood into posterior part of the cavity of orbit, but the vision unimpaired. The back of the head was shaved, and ice applied, and his bowels were kept open by means of pulv. jalap, Co. Patient drowsy.

Nov. 28th.—Blister applied to nape of neck, and camphor mixture ordered. Patient still drowsy.

Nov. 29th.—Patient still drowsy, unable to protrude tongue, and mouth foul. Pulse 64, temp. 101°3.

An abscess which had formed over squamous part of temporal bone was evacuated by means of an opening and counter-opening, and a piece of carbolic-oil lint passed through it.

In the evening the patient was less conscious.

Nov. 30th.—Pulse 57, temp. 100°4. The patient was comatose, with stertorous breathing. Urine contained a quantity of albumen. Prof. Spence determined to trephine. On enlarging the original wound a portion of the internal plate of the frontal bone was found depressed; the trephine was applied, a circular portion of bone removed, also some loose fragments, and the elevator applied to raise the depressed edge. The inner table found splintered; the fracture involved the orbital plate of frontal bone, and extended to the base of the skull, as the frontal bone and its orbital plate moved when the elevator was used. Several small pieces of inner table were removed and a depressed portion elevated. Immediately on this being done the patient, who was not under the influence of chloroform, and had not shown any symptoms of being pained, appeared sensitive, and spoke. A flat compress of sponge, enclosed in gutta-percha, was placed over the trephine wound, and secured by plasters and a roller. Patient soon became perfectly conscious, and recognised those about him.

Dec. 5th.—Patient has continued doing well from the day of the operation until now, under simple treatment. To-day a small allowance of brandy and

water and grain doses of quinine were ordered to be given thrice daily ; the effects of brandy to be watched. A larger compress of sponge applied over wound to prevent any tendency to hernia cerebri.

Dec. 13th.—A small sequestrum which had been separating from margins of trephine wound was removed to-day ; wound looking healthy. Dressed with chlorinated soda lotion.

Dec. 14th.—Vision of left eye impaired, and eyelid inflamed.

Dec. 20th.—To-day use of sponge discontinued, and a pad of lint applied over wound.

An abscess which had formed in upper eyelid and orbit was opened with relief, but vision still much impaired.

Feb. 17th.—Wound healed and vision of left eye improving. To-day patient went home with his mental faculties apparently uninjured.

When I last saw him he had quite recovered, and was engaged at his ordinary occupation.

Remarks.—Although the result of this case was most satisfactory, and gives encouragement to interfere even in what seems an almost hopeless condition, I cannot think it gives any grounds for delaying operation. Had I seen and examined this patient on his admission, I certainly would have operated at once.

CASES OF SIMPLE FRACTURES OF CRANIUM COMPLICATED WITH ACTIVE INTRACRANIAL HÆMORRHAGE.

1. R. M'D., æt. 40, admitted February 15th, 1859, about 3 P.M.—Said to have been struck by a poker on the head, and pushed violently down stairs. He was seen by Mr. Dewar on admission, who described the symptoms under which the man laboured as being those of concussion. He was, however, nearly totally insensible ; the pulse quick and small ; the breathing very slow and gentle.

At 5 P.M. the patient was in a state of complete insensibility ; breathing slowly, but calmly, not stertorously ; pulse 68, full ; left pupil much contracted ; right pupil much dilated ; both insensible to light. On the left frontal region, about an inch above the eyebrow, was considerable ecchymosis, and a small punctured wound, into which a probe could be passed down to the pericranium. Over the parietal and part of the occipital region of the left side there was much ecchymosis of the scalp. About two inches above and behind the left ear the finger could be placed in what seemed to be a depression of the skull, but no wound existed at this part.

At 8 P.M. his breathing had become somewhat stertorous, with slight puffing of the cheeks. Mr. Spence made a crucial incision at the part where the depression of the skull was supposed to exist ; and on passing the finger down, a comminuted fracture was found, and a portion of the bone depressed nearly half-an-inch. The trephine was applied, and a full half-circle removed from the edge of the bone. The depressed portion was then elevated, and a triangular piece, which was lying loose, removed. There was little perceptible change made on the patient's appearance by the operation. He remained perfectly comatose ; his pupils were widely dilated ; his pulse immediately rose to 120 ; and he vomited slightly. He remained perfectly insensible till half-past 1 A.M. of the following morning, when he died.

Post-mortem examination revealed very extensive fracture of the skull, stretching from the point where the trephine had been applied through the squamous and petrous portions of the temporal bone to the foramen magnum on the right side. The right hemisphere of the brain was entirely covered by a thin layer of blood.

2. D. L., æt. 38, fell, on the 27th July, about 3.30 A.M., from a window into the street, alighting on his head. When admitted, immediately after the accident, he had a flushed face, was noisy, excited, and smelt strongly of spirits, but answered questions quite coherently. There was an extensive bruise over the right temporal region, where the patient complained of pain; there was great swelling and ecchymosis of the eyelids, especially the right. There was no external wound, and no depression of the skull. Slight vomiting, but no signs of compression. Pulse 96, and soft. The head was shaved and cold applied, and a cathartic enema was administered. Towards evening, as he was more restless and excited, and the pulse had risen to above 100, he was ordered to have three leeches behind each ear. About 5 o'clock on the following morning I was summoned to the patient, and found him violently convulsed, with a slow and irregular pulse and dilated pupils. In the intervals of the convulsions he was evidently comatose. I made an incision over the point where the patient had complained of pain, and where there was the greatest amount of extravasation, and finding a fissure, immediately trephined. The inner table was found splintered at the edges of the fissure; there was some amount of blood between the bone and the dura mater, and the latter was tense and bulging, and, when divided, a considerable quantity of bloody serum escaped. The patient derived no relief from the operation; convulsions recurred in the course of the day; coma gradually became more profound; and he died in the evening at 10.30 P.M.

Remarks.—In the case of R. M'D., the question of operative procedure required to be very carefully considered. When I first saw the patient the symptoms of compression were of the most decided and urgent character; but then, from the effusion of blood below the scalp, it was by no means easy to ascertain whether the depression felt was really a fracture or the soft pitting in the centre of the hard clotted blood, while the history of the case, as one of concussion, gradually merging into compression after reaction, seemed to point to extravasated blood as the compressing cause; and the occasional convulsions and subsultus tendinum led me to suspect laceration of the cerebral substance. Still, as I felt pretty sure of the feeling of fracture, I determined to incise the scalp to make quite sure, and if I found one, to operate; as, though the other conditions might be present, still a depressed fracture would of itself be sufficient to cause compression, and its removal would give a chance for life. The incision revealed a largely comminuted and depressed fracture, the chief depression being very deep. Several pieces were removed, and the edges of the bone were elevated. There was no blood between the bone and dura mater at the fractured point, but the result of the *post-mortem* examination proved the existence of the other lesions I had dreaded from the history of the case, and were sufficient to account for the fatal result. Still, the propriety of operating in such a case is obvious, as affording the patient a chance, should the depressed fracture be the principal lesion; whilst of course we can have no positive certainty as to the

existence of other lesions, though we may prognosticate them from the symptoms.

The possibility of serious injury of the head remaining latent for a considerable time is well seen in the case of D. L., who, although he had sustained an extensive fracture of the skull, accompanied by laceration of the brain-substance, showed no marked cerebral symptoms for several hours after the accident. On admission, the patient was apparently suffering from slight concussion, which soon passed off, and no alarming symptoms manifested themselves until the following morning, when he was seized with convulsions and subsequent coma. The development of these symptoms, and the period of their occurrence, pointed to extravasation of blood as their cause; while the site of the external injury rendered it not improbable that there was fracture of the skull, with rupture of some of the branches of the middle meningeal artery. The operation, though demanded in the circumstances, was followed by no improvement in the condition of the patient, who gradually died comatose. On *post mortem* examination the fissure was found to extend right across the base of the skull. The base of the brain was also found ruptured at several points, more especially at the line of fracture, and a layer of pus covered its entire surface. The occurrence of a distinct layer of pus over the surface of the brain at so early a period after the accident, is certainly remarkable, and may seem to justify a suspicion of the injury being merely a coincidence occurring in the course of an inflammatory action of the meninges. This, however, is rendered improbable, not only by the history of the case but also by the facts that the pus was most abundant in the line of fracture and at points corresponding to the rupture of the brain-substance, and that the brain-substance itself at these points was undoubtedly the seat of inflammatory action, as proved by microscopic examination.

OPERATION OF TREPAN.

The following extract from a case narrated by Mr. John Bell affords so good an illustration of what I stated in my Lecture on Trepan as to the advantage of using the Hey's cranial saw in certain circumstances instead of the trephine, that I quote it here. Mr. Bell says—

“I made an incision into the tumour, a long incision, which, directed by what I felt without, uncovered a long fracture, the circumstances of which are represented in this sketch. One great fracture (*a*) running down the forehead, passed into the orbit, and was so very wide that it easily admitted the handle of my scalpel; the other limb of the fracture (*b*) ran round in the direction of the coronal suture; the whole piece and corner marked (*c*) was deeply depressed, and so far locked under the edge (*d*) that it was necessary to make those two perforations, and to cut off a small projecting corner with the finger-saw, before we could think of using the lever. The blood rolled out through the first perforation. The depression of the dura mater by the blood was as great as in the former case; the circle in which I could, with the probe, feel it detached, was as wide. The rising of the pulse, which had been oppressed; the recovery from the stupor; the granulation of the dura

mater, and the closing of the wound ; and the daily issue of clotted blood, make this, in all respects, a just parallel with the case I have just related. The extent of the wound was such that the boy was not dismissed till the 9th of January, the 7th of September being the day of his fall. But what surprised and gratified me was this,—The piece of bone marked (c), which had been depressed and elevated, actually moved with each pulse of the brain, so loose did it lie upon the dura mater. I feared, when I saw the dura mater through the trepan holes, red and granulating ; when, on the twentieth day from that of the operation, I found also all the exposed parts of the skull covered with a fine and florid pile of granulations, this triangular piece of bone excepted (which continued yellow, quite bare, and still movable), that it must become entirely carious, and exfoliate ; and that this, by protracting the cure, or by its exposing the brain, might bring the boy into new danger : I had this impression on the 30th of November, and marked it in my daily report : but by the 6th of December the same pile of florid granulations had crept along over the whole surface of this portion of the skull, and by the 14th the whole wound was cicatrised."

Mr. Bell states that when the triangular depressed portion was elevated after removal of a large portion of sound bone by means of two applications of the trephine and section of the intermediate portion with the small saw, he found it so loose that it rose and fell with every movement of the brain, and that he feared from the appearance that it would exfoliate. In his case it fortunately did not, but the chances were all against it retaining its vitality, and it seems to have retarded the cure. Now, by looking at the sketch, plate XXVIII., in fig. 4, you will see that by applying the saw to the fissured base of the loose triangular portion, it could have been withdrawn from under the sound margin at *d*, where the trephine was applied, without any removal of the sound bone, and with the probability of a more rapid cure.

CASES OF FRACTURE OF THE BASE OF CRANIUM.

1. John G——n, æt. 39, while in a state of intoxication fell down a flight of ten steps. He was quite insensible when admitted ; bleeding from both ears (especially the right) and nostrils ; breathing stertorous and slow. Pulse 60, weak ; pupils contracted and fixed. Cold to head and a dose of croton oil was administered. Next day was semi-conscious, drowsy, and complained of severe headache ; vomited violently. Ordered three leeches behind each ear. On fourth day pain much less, pupils natural ; quite deaf, and saw double with left eye ; pulse 72. On the sixth day a blister was applied to nape of neck, with good effects. On the thirteenth day all the above bad symptoms returned, along with facial paralysis on right side ; leeches and purgatives ordered. A seton was afterwards introduced, rest and low diet being constantly enjoined ; and on the forty-seventh day he left, cured.

2. Jane S——r, aged 4 years, was admitted into the Royal Infirmary during the Session 1859-60, in consequence of her head having been crushed under a coping-stone which fell on her, and which was so heavy that it required two men to lift it from off the child. When brought into the hospital she was quite unconscious, with oppressed pulse and stertorous breathing. There was profuse bleeding from the left ear and from the nostrils. Her eyeballs were protruded in a remarkable manner, and the conjunctivæ were ecchy-

mosed, and the tissues of the orbit seemed distended with extravasated blood.

The only treatment which could be adopted was the external application of cold to the head, sinapisms to the epigastrium, and hot bottles to her feet. The coma was so complete that neither food nor internal medicine could be administered except by enemata. A drop of croton oil in mucilage was placed on the back part of her tongue, to act as a purgative. She remained completely insensible for three days, and then began gradually to regain consciousness, and to be able to take food; after which she rapidly improved, and left the hospital perfectly well on the fifteenth day, and continued to be brought, as an out-patient, at intervals, for some time. No bad after-symptoms supervened.

I merely advert to the successful results of these fractures of the base of the skull, as showing that we should not despair even of such cases; for by carefully watching symptoms, and applying proper remedial measures, we may assist nature in the curative process. I would specially notice, as an example of this, the case of G——n, in which there was evidence of extensive fracture, with great bleeding from both ears and nose, injury of ethmoid, and subsequent foetid discharge from that region. The most remarkable recovery, however, of fracture of the cranium, was that of the child whose head was fairly crushed by a large coping-stone (so heavy as to require two men to lift it from off the child). When brought into hospital her head seemed flattened; the cranial bones felt loose, as if broken up; and the eyeballs protruded. The child was completely insensible from compression, and remained so for nearly three days. At first, recovery seemed almost impossible; and the treatment was necessarily limited to the application of sinapisms to the epigastrium and feet, cold cloths to the head, and enemata; yet, when she once began to rally she recovered rapidly, and very little deformity of the head remained. On leaving the hospital she seemed quite lively and intelligent.

CASES OF INJURY OF THE SPINE.—(*From Clinical Reports, Session 1859-60.*)

1. Patrick B——s, æt. 40, was doubled up and crushed by the weight of a horse falling on him, by which several dorsal vertebrae were fractured. Along with complete paraplegia, a low form of peritonitis set in, and he died on the fourth day.

2. John S——s, æt. 26, a strong muscular man, fell backwards over a rail seven feet high. Complete insensibility immediately followed the accident; but on admission, an hour afterwards, consciousness was partially restored, with, however, all the symptoms of paraplegia, and involuntary emission of semen, urine, and fæces. A fracture was discovered at the sixth cervical vertebra. The patient was placed in bed, and the head and neck secured to a pillow. He gradually recovered the power of voluntary movement and sensation. On the twenty-fifth day he went out, and two weeks after, resumed his employment as a brewer.

3. Peter K——r, æt. 38, during the delirium accompanying erysipelas of the head, jumped from the third storey of a house, whereby he sustained a

fracture about the middle of the dorsal vertebræ. For the first ten days he had all the symptoms of paraplegia, requiring the constant use of the catheter. Urine phosphatic. Ordered nitric acid. As the bowels continued constipated, ext. nuc. vomic., gr. 1, with ext. coloc., was administered thrice a day. On the sixteenth day he passed his water without the use of an instrument. After this his appetite and strength gradually improved, and he only suffered from pain over seat of injury, for which a seton was introduced with benefit. Three months and a half after the accident occurred he walked perfectly, and still continues well.

Remarks.—The fractures of the vertebræ furnish us with two instances of successful results out of the three cases recorded. As a general rule, such success is unusual. The size of the spinal cord, and the nature of the osseous canal through which it passes, render it almost impossible that fracture, attended with any displacement, can occur, without such compression or injury of the cord as must lead, either primarily or secondarily, to interruption of its function, and consequent paralysis of the parts below the injury. Fractures, with displacement, occurring in the cervical region, may, especially from the interruption of the vital functions, be regarded as almost certainly fatal; yet, in the case of S., we have an instance of such a lesion, with considerable displacement, terminating successfully. Judging from the train of symptoms observed, although the displacement and crepitus on movement left no doubt as to the nature of the injury, it nevertheless seems pretty clear that the medulla spinalis must have escaped direct lesion; for the complete paralysis and other symptoms, at first urgent, gradually passed off, so that after some hours all the formidable symptoms had disappeared, and in a few days the patient felt so little uneasiness or inconvenience that it was difficult to make him believe the serious nature of his injury, or get him to keep quiet in bed, and avoid moving his head. It is probable, therefore, that the original urgent symptoms were due either to severe concussion of the cord, or perhaps to a certain amount of direct compression without laceration, the compression being relieved when the patient was placed in bed, with the head supported. For my own part, I incline to the former view, and for this, among other reasons, that there never seemed to be any apparent alteration of the displaced bones, the shortening and bulging forward of the front of the neck, and the irregular depression and prominence felt posteriorly, being as marked after the bad symptoms had passed off as they were before. The interest of this case, however, does not terminate with the cure of the primary injury, for, contrary to my wish, he left the hospital on the twenty-fifth day after the accident, saying he felt quite well, and would be very careful of himself at home. I subsequently heard he had returned to his work; and on the 11th of March he applied to be readmitted, on account of gradually increasing paralysis, which had rather suddenly supervened a few days before. The quick pulse and febrile condition of the patient, together with the difficult respiration, and the paralysis affecting parts deriving their nervous supply from above the original seat of injury, led me to infer that secondary changes, the result of irritation and inflammation of the cord and its membranes, were taking place, if, indeed, softening had not actually occurred, and

gave me a most unfavourable opinion of the case. Under treatment, however, the bad symptoms again gradually disappeared, and he was finally dismissed cured.

The case, independent of other points of interest, is instructive, as encouraging to careful treatment even in cases all but hopeless, and as showing the necessity for enforcing absolute and prolonged rest and treatment, although the patient or his friends may consider all danger as past.

LECTURE LXXXVI.

INJURIES OF FACE—Contusions—Wounds—Wounds implicating the Portio Dura—Wounds implicating the Parotid Duct, and leading to Salivary Fistula—Treatment of Salivary Fistula—Wounds of or near the Orbit—Ectropion—Ptosis—Removal of Eye—Extirpation of the whole contents of Orbit—Obstruction of Nasal Duct—Fistula Lachrymalis: Bowman's Operation for its Prevention; old Operation—Fracture of Bones of Nose—Foreign Bodies in Nostril—Epistaxis and its Treatment.

THE INJURIES OF THE FACE most commonly met with are, contusions, wounds, and fractures of the nasal and maxillary bones.

CONTUSIONS OF THE FACE, except when complicated with more serious injuries, seldom come under the care of the surgeon, as every one has some infallible method of cure in which he trusts. Occasionally advice is asked as to the speediest method of getting rid of the disfigurement caused by ecchymosis. If the patient is seen immediately after the receipt of the injury, cold, assiduously applied, often prevents and always modifies the extent of the extravasation and the discoloration arising from it; but if the ecchymosis has taken place, then I know of nothing likely to be of much use except stimulating evaporating lotions to promote more rapid absorption. Time must do the rest. The aid of the artist is sometimes resorted to, but "the effect" is more remarkable than pleasing.

Owing to the great vitality of the textures, WOUNDS OF THE FACE generally heal by the first intention, unless prevented by some special cause. The direction and position of the wound are important. In cases of accidental wounds, causing injury to nerves or other structures, of course the mischief is done, and we can only, in certain cases, try to remedy it afterwards. But the surgeon often requires to make wounds in this region in operating, and for their effects he is responsible. In planning his incisions he must carefully consider the anatomy and functions of the parts which may be affected by his proceedings.

A wound made in certain directions may paralyse one side of the face completely, by dividing the trunk of the portio dura, and then the face is distorted and the patient loses all expression on the injured side. If a surgeon made such a wound without its being absolutely necessary, he would commit a serious error. Any incision in the cheek should, as far as possible, be made more or less parallel to the main branch of the portio dura, and the trunk should never be cut across if it can possibly be avoided.

The same care must be taken in reference to the duct of the parotid gland ; but, as an accidental wound may implicate the duct, and give rise to SALIVARY FISTULA subsequently, we must consider how we can best prevent that condition taking place, or remedy it if it has occurred. In dealing with a wound of the face crossing the line of the duct, we must remember the anatomy of the parts. The duct runs from the ear across the cheek towards the nose, and opens into the mouth, nearly opposite the second molar tooth of the upper jaw. In a wound in this part, when we see that the duct is either cut or likely to be cut, the best treatment is to complete the incision into the mouth. Wounds which penetrate the cheek into the mouth are very seldom followed by salivary fistula, for the saliva naturally tends to pass into the mouth rather than outwards, and the direction and position of the duct favour this, if the external part of the wound be closed at once. If, however, the mucous membrane be not divided, a salivary fistula is often caused by the attempt to close the external wound over the wounded duct. The best plan, in such a case, is to divide the mucous membrane, and then to close the external wound very carefully by silver sutures, whilst the internal wound is left open to allow the saliva to pass into the mouth. When a salivary fistula has become established, we generally find a small opening with callous edges, and a slight trickling of the saliva over the face. This gives rise to a great deal of excoriation of the skin. Digestion also becomes impaired by the loss of the saliva, and the patient may suffer in his general health.

The old operation for parotid fistula was to enlarge the opening and pare off the edges of the fistula, cut into the mouth, and then pass a seton of silk or leaden wire through the opening. One end of the seton was left hanging into the mouth, the other out of the external wound. This was removed after a day or two, and the external wound was closed by harelip suture. The method of operation which I recommend, and which is now usually performed, is to pare the callous edges, by including them in an elliptical incision, and cut through about two-thirds of the thickness of the cheek. The operator then takes two large straight needles, attached to a seton composed either of silk or leaden wire. One needle is passed through the opening parallel to the line of the duct, and the other is passed lower down, leaving a considerable space of the undivided mucous membrane of the cheek between them. Both needles are drawn through into the mouth, so that both ends of the seton hang into it, that the saliva may be guided in that direction. Lastly, the raw edges of the external wound are brought into close contact by fine silver or hair suture. This operation is more difficult to describe than to perform, but I consider it much more likely to be successful than the old method of treating salivary fistula.

Wounds implicating the parotid gland itself are not liable to be followed by salivary fistula. For a time saliva is discharged from the wound, but as it cicatrises the textures consolidate, and the wounded part of the gland is obliterated and ceases to secrete. Should the wound be prevented from healing by the oozing of saliva, pressure, or a touch of a heated wire, will be found effectual in promoting the cure.

Wounds of or in the vicinity of the orbit require attention, as they may affect the functions of the eyelids or lachrymal apparatus, or injure the eyeball itself. Thus wounds of the cheek or forehead, with loss of substance, may, by their contraction, lead to eversion of the eyelids—*ECTROPION*; or wound over the upper margin of the orbit may, by implicating the levator palpebræ, cause drooping of the upper eyelid—*PTOSIS*. The former condition may be remedied by removing a portion of the conjunctival surface of the eyelid, so that the contraction following its cicatrization may counterbalance the external cicatrix; or other methods may be required, such as dissecting the margins of the contracted wound, and transplanting a flap to fill up the gap, and allow the eyelid to regain its natural position. Ptoxis, arising from division of the levator muscle, is not remediable by surgical interference, but after a time the divided muscle forms adhesions, and sometimes acts to a certain extent in raising the lid. I have seen ptoxis follow contusions and superficial wounds over the upper eyelid, apparently due to some affection of the nerve supplying the muscle. In some of these cases a long time elapsed before the power was restored. In such circumstances, after a time, blistering over the superciliary ridge, and sprinkling the blistered surface with a minute quantity of strychnia (about the $\frac{1}{2}$ th of a grain) every third day, will be found useful in restoring nervous power.

Wounds injuring the lachrymal sac or ducts, if they be attended to at first, and if the passage for the tears be kept open during the healing process, generally do well enough. If the inner part of the lower eyelid be drawn down during cicatrization, and the punctum displaced, the tears pass over the cheek. This is remedied by slitting open the orifice of the duct, on its conjunctival side, that the tears may pass into their natural channel.

INJURIES OF THE ORBIT are always attended with danger to the eye, either by directly implicating that organ, or, from the inflammation and suppuration which follow, affecting it secondarily. They may also prove fatal in some cases from the wound penetrating the brain, or leading to inflammation in that direction, hence they require great attention to obviate bad results. In cases where the eyeball is directly injured, if any foreign body be lodged in the cornea, or sclerotic, it should, if possible, be extracted at once, and then strict antiphlogistic treatment adopted to prevent mischief. In cases of wounds inflicted by gunshot, where pellets have passed deeply into the eyeball and orbit, the organ of vision is destroyed, and the presence of the foreign body may, and generally does, excite so much irritation as to necessitate excision of the eyeball, either alone or with the contents of the orbit, to save the other eye suffering, or diseased action extending back towards the brain. In cases of abscess of the globe of the eye following injury, but in which no foreign body remains, there is no need of excising the eyeball; all that is requisite is to completely remove the cornea, and a portion of sclerotic coat, so as to evacuate thoroughly the contents of the globe, and apply warm-water dressing. This relieves the tension, and when the cure is completed, the stump of the eye left

enables the patient to be better fitted with an artificial eye than if the eyeball had been removed.

When REMOVAL OF THE EYE is required, either on account of injury or disease, the nature of the operation will depend on whether we require to remove the eyeball alone, or to extirpate it along with the contents of the orbit. Wherever the injury or disease is limited to the eyeball, excision, or enucleation as it is now termed, is the operation to be performed. It is effected thus:—The patient being under chloroform, and recumbent, the eyelids are separated by an assistant or the wire-spring speculum; the operator with a pair of forceps and scissors raises and divides the conjunctiva a line or two from the cornea, as in the operation for squint, only the incision is carried round the whole circumference of the cornea. He next divides, one by one, the recti and oblique muscles. By means of a sharp hook fixed in the cornea, the eyeball is drawn forwards, the optic nerve cut, and the operation concluded. A piece of lint is pressed deeply into the wound to control the bleeding of the artery of the retina, the eyelids closed, and a compress secured over them. The lint is removed from the wound in a few hours after the operation, and cold-water dressing applied.

EXTIRPATION OF THE CONTENTS OF THE ORBIT is a coarser and more bloody operation. The operator begins by dividing the outer canthus of the eyelids to get room for his after-proceedings; he next passes a needle, armed with a strong thread, through the cornea, that the thread may be used to fix and draw forward the eyeball. The eyelids being separated, the surgeon cuts the conjunctiva round the margins of the orbit, passes his knife backwards along the orbital plate of the frontal bone, taking care to keep its point directed downwards, and sweeps the blade of the bistoury rapidly round the orbit, the eye being drawn forward at the same time to put the textures on the stretch. If the optic nerve has been completely divided, the contents of the orbit are at once removed, or a touch of the knife completes the operation. A sponge is thrust into the orbit to control the bleeding until the surgeon is prepared to seize and secure the divided branches of the ophthalmic artery; a dossil of lint will generally require to be placed in the cavity to control venous bleeding or deep oozing from the central artery of the retina in the optic nerve. The eyelids are then closed and secured with compress and bandage, as in the former operation. The compress and lint in the orbit are removed after some hours, and cold-water dressing applied over the eyelids.

In both these operations an opiate should be given to allay pain, and obtain perfect quiet to prevent bad consequences.

OBSTRUCTION OF THE NASAL DUCT, leading to distension and disease of the lachrymal sac, frequently requires surgical interference, and the kind of interference will depend on the nature of the obstruction, and the stage of the diseased condition we have to treat. The earlier symptoms of this obstruction are the trickling of the tears over

the cheek, and dryness of the nostril of the affected side. The flow of tears over the cheek—*EPIPHORA*, or *STILICIDIUM LACHRYMARUM*—may have other causes, such as increased secretion from irritation of the lachrymal apparatus, from obstruction of lachrymal puncta, or ducts, or from the puncta having been displaced, so that the tears are not directed into them. Or these symptoms may depend not on disease of the nasal duct, but be due merely to congestion of the mucous membrane covering the inferior turbinated bone, or the pressure of a nasal polypus obstructing the free passage of the tears at the lower opening of the nasal duct. The surgeon must therefore examine carefully as to the cause of the stillicidium, and treat the case accordingly. If due to over-secretion, the treatment is to remove the source of irritation, and use sedative and astringent collyria. If the puncta or lachrymal ducts are obstructed, dilatation of the puncta and canaliculi by means of Anel's probes should be had recourse to. If the lower punctum be everted from the result of injury or disease, the simple operation recommended by Mr. Bowman of introducing a fine grooved director into the duct, and then slitting it up on its conjunctival aspect, so as to restore a direct channel for the tears, will prove effectual. When the obstruction is at the lower opening of the nasal duct, then relieving the congestion, or removal of the polypus, is the evident indication. When, however, there is stricture of the nasal duct, the tears gradually accumulate in and distend the lachrymal sac; irritation of and increased mucous secretion from the lining membrane of the sac takes place, and unless actively and properly treated, inflammation and suppuration follow, and fistula lachrymalis may be the result.

There is little use in such cases to try the introduction of dilating instruments, such as probes from the nostril, and still less in putting off time by fomentations or anodyne lotions applied over the distended sac. It is in this early stage, before suppuration has begun, that Mr. Bowman's operation for, or rather to prevent, fistula lachrymalis is most advantageous. It is performed thus:—The lower punctum is first dilated by Anel's probe, or by the point of a common pin, and then a fine grooved director is passed along the duct into the sac: along the groove of the director the surgeon glides a thin-bladed knife, an ordinary cataract knife for example, and *slits open the canal into the sac. This permits him to introduce a silver probe, sufficiently strong, to pass along the nasal duct, and overcome the obstruction. The distended sac is then emptied of its contents, and tepid anodyne lotions applied over the position of the sac for a few hours to allay irritation. In two or three days the probe is passed again, and followed up by a larger one, and thus at intervals gradual dilatation of the duct is effected, and its function restored, without any deformity being left. If, however, suppuration has occurred, with much inflammatory swelling in and over the sac, then Bowman's method will not suffice; for not only will it not permit free exit for the pus and other inflammatory products, but the gradual dilatation cannot be properly carried out. The suppurating sac should be opened like an ordinary abscess, and its contents freely evacuated, and a probe passed down through the canal. Afterwards, when irritation has ceased, dilatation is carried out, at first from above,

but after a time I introduce the probe from below, to permit the opening in the sac to heal.

In cases where the lachrymal sac has been allowed to burst, and no means have been used to clear the nasal duct, the tears pass from the sac through the opening, constituting the condition termed *FISTULA LACHRYMALIS*; and for the cure of this a special operation is generally described. The operator makes tense the eyelids, so as to render the *tendo oculi* distinct, inserts the point of a narrow bistoury below the tendon, directing the edge outwards, and the point backwards and downwards into the nasal duct; then partially withdraws the knife and passes a probe along the blade, and finally lodges a style in the duct; and after a few days removes this, and gradually introduces larger styles, till the duct is fully dilated; then a very fine style with an enamelled head is left in permanently. For my own part, I never could see the necessity for this special operation. The external aperture must communicate with the sac, and all I have ever found necessary has been to dilate the existing aperture, and pass a probe into and along the nasal duct by giving it the proper direction, and then carry out gradual dilatation.

FRACTURES OF THE BONES OF THE NOSE do not require much notice. The fracture is easily diagnosed, and if seen before much swelling has occurred, we can ascertain if there be deformity, and its nature. In young persons the septum nasi yields laterally along with the nasal bones, and the result is a twisted appearance of the nose. At other times, as from a direct blow, the septum and nasal bones are flattened, and then we have the "Fancy Nose" resulting. In all cases there is more or less epistaxis from rupture or laceration of the lining membrane. When the nature and direction of the deformity are ascertained, we pass a director, or the handle of a penholder, or closed dressing forceps, within the nostril, and model the bones into position, and leave them thus without any interference afterwards. We should not, except in special cases, push lint up the nostril to keep the bones in position, for that is very apt to lead to suppuration and necrosis, especially if it be a compound fracture. These fractures usually unite readily enough, and little or no deformity is left if proper treatment be adopted early.

FOREIGN BODIES, such as peas, beads, portions of slate-pencil, or small pebbles, are frequently lodged in the nostrils by children in their play; and when they find that the substance cannot be blown out of the nostril, they or their friends make matters worse by ineffectual attempts to remove the substance. In some cases of older children, the accident is concealed until the irritation of the foreign body has caused inflammation and discharge from the nostril. If the patient be seen before attempts have been made to extract the foreign substance, there is no great difficulty either in ascertaining its position or removing it. But if there has been interference, the foreign body is generally pushed farther back or upwards, and its position is hidden by the bleeding which has resulted from such interference. In cases where the substance has been impacted for some time, the inflammatory swelling and the discharge hide it, whilst the extreme tenderness of the inflamed

mucous membrane prevents manipulation, except the patient be put under the influence of chloroform. In uncomplicated cases the foreign body can be easily seen and felt. The patient should be placed opposite a clear light, and his head held firm by an assistant. The surgeon then introduces a strong flat probe, or an ear-scoop lever, over and beyond the foreign body; but, before attempting to extract it, he should introduce his finger into the mouth to obstruct the posterior nostril, for if the foreign body were dislodged backwards whilst the child is struggling and crying, it might be drawn into the larynx and cause suffocation, or at least necessitate the immediate performance of tracheotomy; hence I always adopt the precaution I have mentioned. In some cases a pair of polypus forceps may be used to extract foreign bodies of a flattened form; but the lever-scoop generally answers best. In cases where ineffectual attempts have been previously made, or in which inflammatory swelling is present, the nostril should be gently syringed with tepid water, to remove blood or discharge, and allay irritation. Then the patient should be brought under the influence of chloroform, and the extraction effected as already described. Should there be any doubt as to the presence or position of the foreign body, the nasal speculum should be used, after we have washed out the nostril to remove blood or discharge.

EPISTAXIS, OR BLEEDING FROM THE NOSE, frequently follows all accidents or operations about the nostrils. The hæmorrhage is often of a serious character, and requires efficient means to arrest it. This form of bleeding also occurs idiopathically in patients in whom there is a tendency to cerebral congestion or disease. When we do not wish

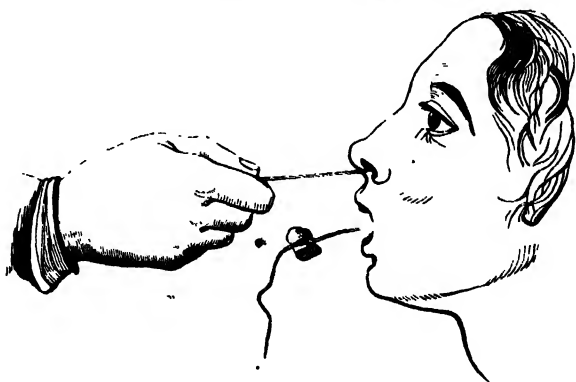


Fig. 163.

to check it very rapidly, the application of cold, or plugging the anterior nostril, may be sufficient to arrest it. This is, however, seldom sufficient, for if the bleeding be at all serious it will take place by the posterior nares, and the blood will pass into the stomach, giving rise to vomiting, and the patient may suffer from the loss of blood. Hence we generally plug the posterior nares first, and then the anterior, so as to command the bleeding completely. Various instruments have been

invented for the purpose of plugging the nostrils, but an ordinary gum catheter is quite sufficient. The stilette having been withdrawn, the catheter is introduced into the nostril and brought out of the mouth ; a plug of lint secured to the centre of a piece of strong cord is then tied on it, and is drawn back into the posterior nostril, and firmly impacted there. Both ends of the cord are then tied together loosely at the angle of the mouth. The plug is left in for forty-eight hours or so, and then drawn out from the posterior nostril. I do not approve of using a sponge for plugging the nostril, as it swells from the mucus and blood, becomes slippery, passes out of the posterior nostril, and hangs down the throat ; but if a plug of lint be firmly lodged in the nostril this is not likely to happen.

LECTURE LXXXVII.

Polypus of the Nostril: Simple; Fibrous and Malignant; their Symptoms and Treatment—Ozæna and its Treatment—Ulceration of the Septum Nasi—Rhino-plastic Operations: by Flaps from the Fore-head or Cheeks—Liston's Operation for restoring the Columna Nasi—Partial Restoration of the Nose by Flap from the Arm.

SIMPLE POLYPUS OF THE NOSTRIL is a very common affection. I have already spoken of it, as an example of simple tumour growth, when lecturing on tumours. The general symptoms which indicate its presence are a feeling of stuffing of the nose, as if from a cold in the head, and an increased secretion of mucus from the nostrils. As both these symptoms are increased in cold damp weather, the patient for some time attributes his symptoms to a cold; but as they become persistent, and the difficulty of breathing through the nostrils becomes greater, he examines his nostril, and detects a soft swelling; or some of his friends observe it. In many cases the bulky mass presses on the margin of the inferior turbinated bone, and obstructs the flow of tears through the nasal duct, and they then flow over the cheek, giving rise to one form of epiphora. When any of the polypi project towards the pharynx through the posterior nares, the patient feels as if some mucus were adhering to the back of the throat, and is constantly hawking and spitting to get rid of it. When very long and pendulous in this position, the irritation of the fauces sometimes excites vomiting. In many cases the projection of a polypus may so press upon the orifice of the Eustachian tube as to cause deafness. In all cases, as the growths enlarge and fill the nostril, the sense of smell is impaired, and the voice is indistinct and snuffling, and when the patient falls asleep he snores loudly.



Fig. 164.

In cases of simple polypi there are generally several present at the same time in the nostril, and often several small ones are sessile around the roots of the more prominent. Hence it is sometimes said that these simple polypi return after removal. This is not the case; but the small ones constituting the second crop, and which were formerly unnoticed, grow up, and occupy the room vacated by their more advanced predecessors. It is therefore not a recurrent tumour; but we cannot always be sure of removing every polypus. Their most usual habitat is the mucous

surface of the superior and middle turbinated bones. From this position they often hang in clusters down the nostrils. A polypus occupying the anterior nostril, with a long narrow attachment, may slip backwards into the posterior part. We should therefore always introduce a finger into the mouth, and feel the posterior nostril, in order to ascertain if there are any polypi there.

The diagnosis of nasal polypus is usually simple enough; at the same time we must see that it is really a polypus we have to deal with. It often happens that a patient has the ordinary symptoms of polypus, and that the surgeon supposes he sees one when there are none present. The mucous lining over the inferior turbinated bone is often congested and cedematous, and looks exactly like a polypus, and the septum between the nostrils is sometimes placed unevenly, and has the appearance of a polypus. Hence we require to be careful in examining the nostril, but once we have ascertained the presence of such a growth, the treatment is very simple.



Fig 165

To remove these simple polypi, we introduce a pair of polypus forceps into the nostril, by means of which a firm hold is taken of the root of the polypus; which is then wrenched or twisted off from its attachment. This is repeated until all the growths which can be seen or felt are removed.

In some cases, where there are a number of small polypi which are difficult to get hold of, I proceed as if I were going to plug the posterior nares, by using a small dossil of lint, and drawing it forwards. By this means I often drag away any small polypi which may be present; and though it looks a harsh proceeding it is not a painful one.

There is another and more formidable kind of non-malignant polypus



Fig. 166.

—the Fibrous. In some extreme cases of fibrous polypi, great deformity occurs: the nasal bones and the walls of the antrum yield, and the face assumes the character termed "Frog-face," represented in fig. 165. In some cases of fibrous polypus, arising from the lower surface of the basilar process, portions of the growth invade the orbit, and evert and protrude the eye, and at the same time distend the antrum and press down the palate so as closely to simulate malignant tumour of the upper jaw, as in that of the boy here represented (fig. 166).

We may have a FIBROUS POLYPUS occupying the whole nostril and hanging down the throat. This form of growth is very firm, and is generally attached towards the posterior nares or pharynx. When in that position we can twist it out by means of a pair of strong-toothed forceps. In some cases we can snare it in a loop of double-twisted wire, which may then be used as an *écraseur* to separate the polypus gradually, and extract it by the mouth, or we may tighten the wire from time to time till the polypus drops off. In the more extreme cases, referred to above, we may have to slit open the nose, or perform excision of the upper jaw; and as in such cases, especially in young subjects, there is a risk of the bones of the base of the cranium yielding if great force be used in attempts to twist off the polypi, I would advise section of their pedicles, with knife, or scissors, and touching the cut surfaces with the actual cautery.

Another form is the MALIGNANT POLYPUS. This is rather a malignant medullary tumour than a polypus, and its character is known by the bleeding from the nostril, the age of the patient, and the nostril becoming rapidly plugged up. We should not remove it, for it would recur again immediately, and the great mass of the growth is deeply situated, springing from the ethmoid cells, so that it would do no good to remove merely the projecting portion. Besides, such operations are likely to be followed by excessive hæmorrhage, which is very difficult to arrest.

OZÆNA is a disease of the nose and frontal sinuses, characterised

by a thin and fœtid discharge. The odour of the discharge is peculiar—not a strong but a very offensive fœtor. On examining the nostrils, the mucous membrane seems swollen but not very vascular, rather of a yellowish tinge, but in some instances congested. On examining the nose with the speculum in a strong light, if the disease is at all advanced we observe numerous superficial aphthous sores, not larger than the surface of a millet seed. The patients are generally pale and unhealthy looking. In truth, the disease is one of the manifestations of scrofula in most cases, although some elderly people, otherwise healthy, have told me that the discharge had existed for nearly half their lifetime; but these are exceptional cases, and in most of them the discharge of thin mucus was chiefly from the frontal sinuses. The treatment of ozæna consists first in using means to improve the general health, by administering iodide or bromide of potassium, cod-liver oil and iron, and generous diet. The local treatment I usually adopt at first is to make the patient apply a lotion of Condyl's fluid to the affected membrane by means of a hair-pencil or syringe, and once or twice a day sniff up the fumes of tincture of iodine diffused in boiling water. When the aphthous sores are present they should be brushed over with a solution of sulphate of copper from time to time, the Condyl's fluid being used as an ordinary wash. Sir John Rose Cormack informs me that he has found spraying or injecting the nostrils with an infusion of leaves of the *Eucalyptus globulus*, very effectual in destroying the fœtor and improving the local disease. In many cases great benefit is derived from blisters applied behind the ear. In cases where the membrane of the frontal sinuses is affected, the blister should be applied to the forehead. These cases are always tedious, and exercise the endurance both of the patient and the surgeon.

ULCERATION OF THE SEPTUM NASI is sometimes met with, and has often progressed to perforation before the patient's attention is drawn to it. In most cases it begins in a small pimple or pustule on one side of the septum. This is irritable rather than painful, and the patient does not think of applying for medical advice. The irritation leads him probably to be touching the part, or he picks the pimple, and so an irritable ulcer is formed, which gradually eats through the septum. On discovering the hole the patient becomes alarmed, and seeks surgical aid. Such ulcers almost invariably assume the circular form, their edges are irritable, and the surrounding texture congested at first; but they often assume a low chronic action from a very early period, with somewhat callous margins, which cicatrise from time to time, and then break out afresh, and so the ulcer extends until the septum may be undermined and give way. In almost all the cases I have seen there have been constitutional causes in operation; either scrofula, or that and hereditary syphilis combined, or the ulcer has occurred as one of the symptoms of tertiary syphilis. In a few cases it seemed to be the result of mere local irritation, and in these the cure was correspondingly speedy and complete. You will understand from what I have just said that attention to the constitution generally forms the principal part of the treatment, which must be conducted on

the general principles already laid down. The local treatment consists in the direct application of nitric acid to the sore, to destroy the diseased parts, and arrest the action. This should be followed by the use of Condy's fluid diluted with distilled water, and at a later period lotions of sulphate of copper, or chloride of zinc, may be required to assist the healing process. Patients are often anxious that the opening in the septum should be closed, and are disappointed when they find it does not close under the treatment; but they should be made to understand that the object is to arrest the spreading of the disease, and that contraction or closure of the ulcerated aperture cannot be effected artificially. Plastic operations, or rather attempts at them, uniformly fail, from the sloughing of any flap introduced, the secretion of the nostril interfering with union; besides, paring the edges of such an ulcer is almost sure to re-excite the local ulceration.

When lecturing on the subject of lupus, I adverted to the plastic operations which we sometimes have recourse to, with a view of restoring the nose, and remedying deformity. I then warned you against performing such operations until a considerable period had elapsed after cicatrisation of the ulcerated surface. Even after a lapse of time such cases are liable to recurrence of unhealthy action, and our plastic operations may be unsuccessful. Still, in many such cases, when the disease has been healed for some time, and the patient's general health restored, or in cases where the nose or portions of it have been lost from injury, we have recourse to operative measures to remedy the deformity.

When I was a student, RHINOPLASTIC OPERATIONS were very fashionable, and very great favourites with Mr. Liston. The method he pursued, and which was then generally practised, was a modification of the native Indian plan, represented in fig. 167. The flap was taken from the forehead, and the columna afterwards formed from the upper lip; the latter a modification first used by Mr. Liston, and one of great importance in whatever method the nasal flap is formed. Albeit there was no chloroform in these days—the operation, a tedious, and, I should think, a painful one—the applicants for improved appearance were numerous, for “pride feels no pain;” and I well recollect on one occasion seeing three of these operations performed by Mr. Liston in one day, and two of the patients

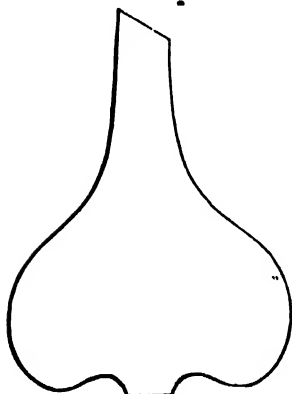


Fig. 167.

sitting with the nasal flaps hanging down till the oozing ceased, whilst the third was undergoing the operation.

But although I had the advantage of seeing the operations of a master-hand, I never was favourably impressed with the results; more especially as it always appeared to me that the peculiarly disagreeable expression, resulting from the cicatrisation of the large wound on the

forehead, more than counterbalanced any improvement from the restoration of the nose. As years passed on, and I had opportunities of seeing many of the patients on whom these operations had been performed, this adverse opinion was confirmed, for the "renaissance," which had some appearance of a nose when first made, had almost in every case become "small by degrees," not "beautifully less"—in fact, degenerated into a sort of indefinite lump, where a nose should be. In some cases where the original flap had been of such dimensions as to provoke a little merriment at the time of its adjustment, a somewhat better nose remained, but never such as to me seemed any great improvement, whilst the ugly expression caused by the scar in the forehead had certainly not improved. From this feeling, I have never performed the rhinoplastic operation by that method, nor can I recommend it. But in cases where the cheeks are full and their textures healthy, and in which the septum nasi is tolerably entire, a very presentable nose may be formed by flaps dissected from the cheeks by the following method:—Two thick flaps of skin, of the form shown in the accompanying woodcut (fig. 168), are traced on the cheeks, and then dissected up, taking care to retain sufficient substance to ensure vascular supply. These flaps are then brought forward without twisting, and, when all oozing has ceased, the margins A B and A C are approximated and retained by points of silver suture. The outer margins at E and D are attached by silver suture at such a distance from the openings of

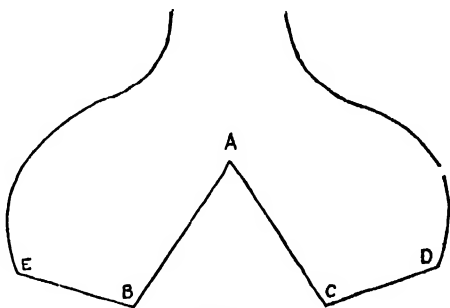


Fig. 168.

the nose as would correspond to the original *alæ nasi*, and the remainder of the outer free margins implanted into the raw surface by points of silver suture, or small pins pushed in obliquely. After the lapse of forty-eight hours a small dossil of lint may be introduced to raise the flaps and give form to the nose, and that elevation is gradually increased after union has taken place. Lateral pressure from without by forceps made for the purpose may also be used with advantage at a later period, but the effects of pressure must be watched. Lastly, when two or three months have elapsed, and union is thoroughly effected, the *columna nasi* is formed by cutting it from the upper lip, as first practised and described by Mr. Liston. "The inner surface of the apex is first pared. A sharp-pointed bistoury is then passed through the upper lip—previously stretched and raised by an assistant—close to the ruins of the former *columna*, and about an eighth of an inch on one side of the mesial line. The incision is continued down, in a straight direction, to the free margin of the lip; and a similar one, parallel to the former, is made on the opposite side of the mesial line, so as to insulate a flap about a quarter of an inch in breadth, and composed of skin, mucous membrane, and interposed substance. The *frænulum* is then divided,

and the prolabium of the flap removed. In order to fix the new columna firmly, and with accuracy, in its proper place, a sewing needle—its head being covered with sealing-wax to facilitate its introduction—is passed from without through the apex of the nose, and obliquely through the extremity of the elevated flap: a few turns of thread over this suffice to approximate and retain the surfaces. The flap is not twisted round as in the operation already detailed, but simply elevated, so as to do away with the risk of failure. Twisting is here unnecessary; for the mucous lining of the lip, forming the outer surface of the columna, readily assumes the colour and appearance of integument, after exposure for some time, as is well known." The fixing of the columna having been accomplished, the edges of the lip must be neatly brought together by the twisted suture, or silver wire suture, as in harelip, after the edges have been raised. "Some care is afterwards required, from both surgeon and patient, in raising up the *alæ*, by filling them with lint—thus compressing the columna, so as to diminish the œdematous swelling which takes place in it, to a greater or less degree, and repressing the granulations. It is, besides, necessary to push upwards the lower part of the column, so that it may come into its proper situation; and this is done by the application of a small round roll of linen, supported by a narrow bandage passed over it and secured behind the vertex."

The wounds of the cheeks from which the flaps have been dissected are stitched at the outer parts, and closed as far as can be done without straining the skin. The remainder heals by secondary union, and the contraction which follows rather improves the appearance by projecting the new nose more in relief.

Partial restoration of the nose can be practised with very great benefit by transplanting portions of the cheek texture to supply the deficiency; and as the opposite side of the nose and septum are present, the results are very satisfactory. The flaps should be cut with a long and somewhat narrow but very thick pedicle, to avoid the necessity for twisting; but so thick as to retain ample vascular supply for the flap. Their shape must vary in different cases; but the accompanying figures will give some general idea of their form. When the flaps are taken from the cheek there is no deformity left from the scar, so that, even if the operation fails, the patient is no worse than before; whereas, in the forehead flap, great deformity remains. In the case of a lady who, in childhood, had suffered from *cancrum oris*, which destroyed one side of the cheek and nose, I restored the cheek and form of the mouth by dissecting a flap from the neck, but I could not get sufficient to form the side of the nostril, and I advised her to get an artificial substitute. Eighteen months afterwards, however, she returned, with the determination to have the side of the nose repaired by operation. Of course I could get nothing from the cheek in her case, and I explained my objection to cutting a flap from the forehead. But as she was very determined to have something done, I told her that if she could bear very irksome after-treatment, I would form the side of the nose from her arm. She at once decided to have it done; and I accordingly cut a large flap from the inner and anterior aspect

of the upper arm. After paring the edges of the nose and cheek the flap was fitted and attached by sutures, the arm was supported by an apparatus especially arranged to suit the case, and retained in position for eight weeks before I could venture to sever the attachment of the

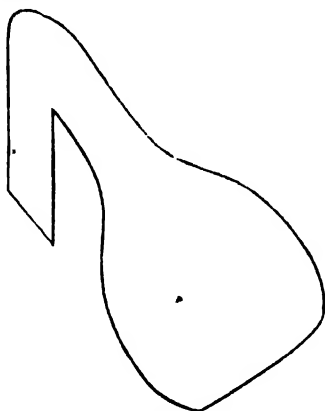


Fig. 169



Fig. 170.

flap. I was at first rather anxious as to union at the part attached to the margin of the recently-formed cheek, but everything went on favourably, and my patient's firmness was rewarded by a decided improvement in her appearance. I should, however, think very few persons will be found who would carry out the treatment or bear the irksome position of the arm with the determination she did.

LECTURE LXXXVIII.

Ulcers of the Lips—Epithelial Cancer of Lip: Operations for its removal; Cheiloplastic Operations—Harelip and Cleft Palate: Operations for the remedy of these Congenital Deformities.

WE have too little time to enter fully into the details of the numerous surgical diseases about the mouth. I shall therefore merely notice the more important.

The LIPS are subject to various forms of ulceration, some simple, from mere local irritation, the effects of cold, or from disorder of the digestive organs. Such ulcers are generally of an aphthous character, and require little local treatment beyond protecting them from exposure to fresh irritation. The constitutional treatment must depend on the predisposing cause. When speaking of syphilis, I stated that occasionally we meet with chancres of the lip, and mucous condylomata. These latter, when ulcerated on the surface, may lead to wrong diagnosis, as the local appearances very closely resemble those of certain forms of epithelial cancer of the lip, and therefore the surgeon requires to be cautious in his diagnosis, especially when the ulcer is present in young persons, in whom epithelial cancer is not common. In most instances the co-existence of eruptions, or the marks left by eruptions on the skin, and the state of the throat, will confirm his suspicions if the ulcer be of a syphilitic character, and then the adoption of the treatment proper to that condition will speedily cure the local sore.

The CANCROID AND CANCEROUS ULCER OF THE LIP is most frequently met with in the lower lip in old people, and the exciting cause is often traceable to long-continued local irritation, caused by smoking a short pipe, or by the presence of some irregular tooth. The characteristics of such ulcers are a warty or villous irregular surface, and extreme hardness of the base of the sore. They vary much as to extent and the direction in which they extend. Thus, some are confined to a small space of the prolabial surface, but the hardness involves the textures of the lip towards the chin, or angle of the mouth. Others extend very superficially along the length of the prolabium; or the surface and some depth of texture may be affected, whilst the skin and mucous membrane of the body of the lip may be unaffected.

The *Treatment* is excision of the diseased part before the glands have become involved. There is no use in trying escharotics, as

it will be found that even when the surface of the sore heals after destruction of the ulcer by such means, gland-tumours form in the submaxillary region, whilst their application is much more painful than the operation of excision. We must vary our procedure according to the position, form, and extent of the disease. In the smaller and more defined cancrroid ulcer of the lip we include the diseased part in a



Fig. 171.

V-shaped incision, and remove the part so marked out, taking care to cut wide of the disease. In making the incisions the texture of the lip should not be stretched by the assistant, as that is liable to render the surrounding hardness less distinct. The bleeding should be commanded by pressure on the facial artery against the lower jaw in front of the masseter muscle, and the lip held loosely whilst the incisions are being made. After the cancerous portion is excised, the vessels are twisted, and the margins of the wound approximated by silver sutures, so that little deformity is left. In cases where the warty ulceration occupies the length of the prolabium superficially, we project the ulcerated surface, and remove it with a pair of curved scissors, and unite the edges of the skin and mucous membrane. If there be some depth as well as length of surface involved, we include the diseased part between the lines of a prolonged elliptical incision, and dissect off the skin and prolabium, remove the diseased structure, and then, after securing the vessels, re-unite the margins of the skin and prolabium. In many cases the disease involves so much of the substance of the lower lip that its removal would necessarily leave the teeth exposed, and allow the saliva to be constantly running out of the mouth. In such cases our procedure ought to be so arranged that we may at once remove the cancerous part, wide of the disease, and at the

same time replace it by a substitute lip, formed by what is termed the Cheiloplastic Operation.

Suppose we have to deal with a cancerous ulcer with induration, involving a great extent of the lip both in length and depth, we begin by making two incisions, one from either angle of the mouth, converging at the chin; we then dissect away the triangular part included. By means of these incisions we remove the whole diseased lip, and mark out part of the flaps from which the new lip is to be formed. From

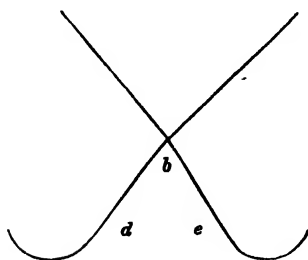


Fig. 172.

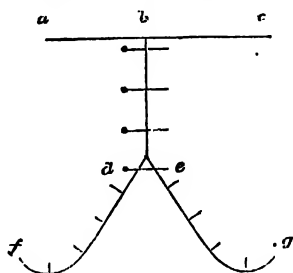


Fig. 173.

the apex *b* of this large V-shaped incision (fig. 172) we next carry downwards and outwards two oblique incisions to the points *d* and *e*, and then with a curve to *f* and *g*, we mark out two flaps in the submaxillary region. The flaps are now to be dissected from over the lower jaw and submaxillary region, and detached so far as to enable us to bring them into the positions indicated in fig. 173, of the accompanying woodcut, without straining or twisting. Finally the cervical wound is closed as far as possible without giving rise to tension. The laxity of the skin in the cervical region allows this to be done to greater extent than we might expect, and the cervical wound heals by granulation.

Various plastic operations are required to remedy partial destruction of the lips and cheek, resulting from cancerum oris, or other causes, but it is impossible to lay down rules for such irregular operations. The surgeon must plan the operation to suit each particular case. In planning such plastic operations I would refer you to what I said when speaking of plastic operations for removing deformities caused by burns.

HARELIP consists of a congenital gap through the substance of the upper lip, involving its whole thickness. It is sometimes associated with deficiency of texture, and always presents that appearance, owing to a wide gap being caused by the unopposed muscular contraction on either side of the fissure. This gap, or deficiency, not only exposes in an unseemly manner the teeth and gums, but so interferes with the proper functions of the lip as to render eating difficult, and proper articulation impossible. The expression of the face is necessarily very much altered by it, and the discomfort and deformity are generally so great as to induce the parents to seek surgical aid at an early period.

The fissure may be single or double; and it may be complete or partial in its extent. A complete fissure severs the whole lip, and extends up into the nostril (fig. 174); a partial one divides the lip to a

or less extent, in the same direction, without extending so far as the nostril. Whether there be one or two fissures, neither is ever situated in the middle line, but to one or other side of it; hence the term *harelip* does not accurately describe it. When there are two fissures, the groove below the column of the nose is generally represented by an island or isthmus of sound skin, it being sometimes separate

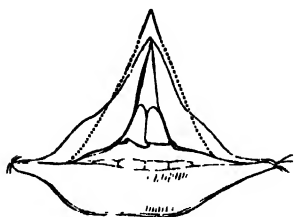


Fig. 174.

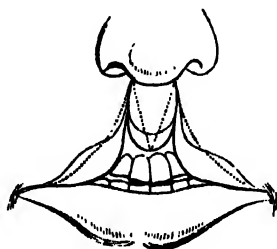


Fig. 175.

from, and sometimes continuous with, the septum of the nose—generally the latter (fig. 175). This is taken advantage of in operating, as I will afterwards show you. In addition to this, there is usually an irregularity in the alveolar process, corresponding to either or both notches in the lip. This deformity may assume the character of either a deficiency or redundancy, very frequently the latter. An intermaxillary bone is frequently present, and projects at the fissure. Sometimes the alveolar process is divided, and a portion of it, with its corresponding tooth or teeth, turned curiously outwards, as if in adaptation to fill up the gap in the lip.

The *Operation* for Harelip may be performed at almost any period of life; but where you have a choice the preferable time is early infancy, or after the first dentition is complete, and the child two years old. As the lip, after being operated on, is apt to shrink upwards into a modified notch, marking the site of the original fissure, the great desideratum in connection with the operation is a lip free from this defect. With the view of effecting this it is desirable to leave a redundancy of texture at the lower portion of the wound. The operation consists in paring or rawing the labial margins of the gap, freely dividing the attachments of the mucous membrane of the cheek from the jaw, and then placing them together in close and accurate apposition with points of silver suture or harelip suture; but in order to get a redundancy of texture at the margin of the lip, it is necessary to employ either angular or elliptical incisions, both of which I have used with success. The angular incision is begun on either side at a point above the base of the fissure, and brought down in a straight line to the upper margin of the prolabium, where it is directed inwards at an obtuse angle (fig. 176). Thus, when the two straight edges are brought together, the labial margin will be excessive rather than defective; but

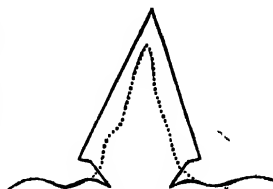


Fig. 176.

the excess will soon be remedied by absorption. You will readily understand that a like result will be obtained, and perhaps in a simpler manner, by employing two curved incisions, their concavities being directed towards each other, so that when the lips of the curves are approximated and brought into line, the lower extremity of the united line will exhibit a redundancy of texture. This is the mode of operation I generally employ, and its simplicity and success have decided me in giving it the preference for most cases of harelip. After the margins have been closed by silver sutures, the mucous surface should be secured by a point of silk suture, to prevent saliva entering the deep aspect of the wound.

The operation for the double deformity is conducted on the same principles, and must of course be modified according to circumstances. Where there is an isthmus of skin depending in the middle line, I raise it up and employ it in supplementing the columna of the nose, which is generally defective. This I find to be more advantageous than to pare it into a wedge-like form, and employ it in patching up the new lip, as is sometimes done, as represented in fig. 175. When the intermaxillary bone is present, we either break its narrow pedicle and forcibly repress it into position, after dissecting off the soft parts, or we divide the pedicle with bone-pliers, and remove the bone. The former is the preferable method when we can adopt it. In either case it should form a preliminary operation.

The mistakes you are likely to commit as beginners are to remove too little texture in paring the edges and omit freeing the attachments of the mucous lining of the cheeks. This conservatism is suggested by the apparent dearth of material to supply the existing defect; but that deficiency is more apparent than real. In drawing the edge of the wound together, we have to draw largely on the elasticity of the component textures; and lest the sutures should of themselves be insufficient to keep the ground we have gained in this way, we generally draw the cheeks towards each other by strips of adhesive plaster, causing the lip to pout.

This can be done more effectually by means of an apparatus, formed somewhat like a double truss, consisting of a circular spring and two pads. The spring is applied round the back of the head, and the pads are adjusted so that one is made to impinge on either cheek. It is kept in position by means of a cross strap applied over the forehead and vertex. I have never used this myself, but it has been found of advantage.

The bleeding must be arrested by torsion. No approximation must be attempted until it has entirely ceased, unless we use the harelip-needles, when these are made to compress the vessels.

Chloroform may or may not be used. If given, care should be taken that the child has had no food for some hours before the operation, lest it cause sickness.

The condition known by the name of CLEFT PALATE consists of a congenital malformation, in which the arch forming the roof of the mouth, instead of being continuous and entire, is interrupted by a

longitudinal fissure or gap in its substance. This deficiency may be partial, affecting the soft palate only, or it may be complete, involving the hard palate also. Sometimes aggravated forms of it are met with, in which the fissure extends forwards through the alveolus and upper lip into either nostril; and there are minor degrees of it, in which the fissure is represented by a short oval slit in the vault of the mouth, bounded both anteriorly and posteriorly by sound parts. Various explanations of its origin have been advanced. Some refer it so far back as to make its commencement coeval with the closure of the first visceral arch in the embryo. Others date it from arrested development at a later period; while a third theory attributes it to separation of the still imperfect parts by causes distending the fetal head.

The *Operation for Split Palate* cannot be shown properly on the dead subject, unless the malformation be present. When the soft palate alone is involved, the operation required is comparatively simple.

What we have to do is to pare the edges of the slit in the palate, and bring them in contact by points of suture. The danger is that the tension may cause the sutures to ulcerate out. Moreover, the constant irritation of the part by saliva and foreign substances in the mouth, and the attempts of the patient to swallow, are apt to break up the newly-united edges, and render the after-treatment rather troublesome. Still the operation for the soft palate is comparatively a simple one. Various methods have been proposed to relieve the tension. Sir William Fergusson proposes to divide the muscles which render the palate tense, and also to divide the muscular fibres contained in the pillars of the fauces, the palato-glossus, and palato-pharyngeus. This renders the tension somewhat less, but the injury done by interference with the soft textures, and the division of the muscular fibres, may lead to suppuration, and so defeat the object we have in view.

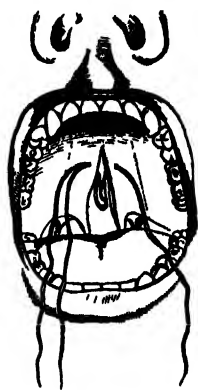


Fig. 177.

In bringing the edges of the wound together we should use silver instead of silk sutures, as silk creates more irritation than the silver wire. In putting in the sutures I leave a considerable space between the points where the needle is inserted and the free margin, so that there may be a considerable thickness of texture intervening. Five or six sutures should be inserted in all. Formerly there was sometimes a difficulty in getting hold of the right ends of the sutures, but an instrument has been invented which obviates this difficulty—a coronet with projecting pegs, to which the ends of the sutures are fixed.

In the other form of the disease there is a split and deficiency in the hard as well as in the soft palate. Langenbeck and others have lately introduced a method of operating for this condition, founded on the researches of Ollier with regard to the periosteum. He fills up the gap in the hard palate by separating the gum-texture, and the periosteum along with it, from the palatine surface, and pushes it in towards the

cleft. This operation is much more difficult than the former, and requires much time and patience in its performance. Very careful dissection is required in separating the palate from the arch of the mouth, and the palatine plate of the superior maxilla and the palatine bone proper are generally much more vaulted in such cases than usual. The first thing is to pare the edges, both of the soft and hard palates; then make an incision with a bistoury close to the edges of the gum, on either side, leaving a small portion in front unseparated, so as to preserve its vascular connections entire; then, with a double-edged knife, curved on the flat, separate the periosteal texture from the bone. This is done on both sides. It will generally cause considerable bleeding, and we must wait till this ceases before proceeding with the operation. When bleeding has ceased, we bring the parts together by points of suture, but this is not very easily done, and we require to have several needles for the purpose; the spring needle of Langenbeck answers best in most cases. The operation is a tedious one, and in many cases, after all, the result is unsuccessful. As a general rule, I think that the best plan in the more complicated cases, in the case of adults, would be to perform the operation on the soft palate first, and not to complete the whole operation at one sitting; rather than attempt too much. If the operation on the hard palate fails, it is very apt to implicate the soft palate. It would therefore be less troublesome, and more likely to be successful in many cases, to do the two parts of the operation on different occasions.

In performing the operation for Cleft-Palate, when the hard palate is involved, and also in some other operations, on the mouth, there is risk of blood passing down the air passages and occluding the bronchial tubes. To obviate this danger Langenbeck and some other surgeons perform tracheotomy as a preliminary, and then plug the larynx by means of a special apparatus.

There is no doubt very considerable risk in some cases from the bleeding, but the performance of a serious operation as a preliminary to another for removal of a deformity, is, I think, of doubtful propriety.

A simpler method of preventing the risk alluded to is that recently proposed,—to place the patient with the head hanging back over the end of the table, so that the opening of the larynx is above the level of the palate and the blood gravitates towards the upper part of the pharynx.

I have not yet tried this method; but although the position must be an irksome one for the patient in a prolonged operation, it is certainly preferable to tracheotomy, and deserves a fair trial.

LECTURE LXXXIX.

Inflammation and Abscess of the Tonsils—Chronic Enlargement of the Tonsils—Excision of Tonsils—Ranula and other Sublingual Tumours—Salivary Concretions: their Symptoms, Diagnosis, and Treatment—Glossitis—Chronic Hypertrophy of the Tongue—Ulcers of the Tongue—Epithelial Cancer of the Tongue: Operations for its Removal—Tumours of Palate.

THE TONSILS are subject to attacks of inflammation, which may terminate in suppuration. There is great swelling in the throat, with difficulty of breathing and swallowing, and much fever in proportion to the extent of the disease. The patient is often very much exhausted also, from want of food, and much depressed from the irritative fever which is present. All these symptoms may be relieved by making an opening early, if suppuration be suspected, for the pus may form very deeply in the tonsil. In no case is there any danger in cutting into the tonsil; and an incision made to reach an abscess, even though the pus has not formed, can do no harm. It relieves the congestion of the parts, and in fact we often scarify the tonsil just to modify the inflammatory action. We cannot of course feel fluctuation readily at an early stage of the disease in parts so deeply seated as the tonsil. A common bistoury is the best instrument for cutting into the tonsil, and it should be passed directly backwards in the line of the second molar tooth, the edge being directed inwards and upwards, for it is important to remember the close proximity of the large vessels of the neck to the base of the tonsil. There is no danger, however, to these parts, if the knife be passed fairly from before backwards into the abscess of the tonsil, and then carried upwards. The danger of non-interference in such a case is, that the abscess may burst in the night, when the patient is asleep, and suffocation occur. From the congested state of the parts, we may, and indeed pretty often do, have rather smart bleeding when we open the abscess, but we need not be alarmed at this, as it soon stops, or can be arrested by touching the wound with perchloride of iron.

As regards CHRONIC DISEASES OF THE TONSILS, we have chronic enlargement of them with condensation of their texture. In delicate children this very often occurs, and they may attain to such a size that the two tonsils almost close up the fauces, and give rise to difficult breathing, especially at night, when the patient lies on his back, and the nares become plugged with mucus. It is altogether a very unhealthy state of matters, for it interferes with the proper aëration of the blood, and therefore the sooner the disease is removed the better.

The tonsils, on examination, are seen to be of a pale colour, and of a pretty firm consistence, though occasionally they may be somewhat vascular and spongy; these latter cases being not so favourable as the others. They nearly meet in the middle line, and they also project both upwards and downwards between the pillars of the fauces. In these cases the simplest and the best treatment is the removal of the projecting portion of the gland—excision of the tonsil, as it is generally called. This is an unfortunate name, for we do not excise the tonsil; we merely cut off a portion of it, and subsequently condensation of the remaining portion of the tonsil occurs, and the part contracts. To remove the tonsil it should be drawn towards the centre of the mouth

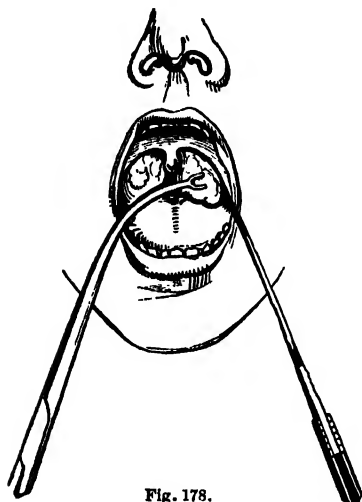


Fig. 178.

with a vulsellum, and then a straight probe-pointed bistoury is passed fairly below the projecting portion of the gland, and carried directly upwards, without any sawing motion, and to effect this the knife must be very sharp (fig. 178). We should remove both tonsils at the same time if possible, or the second may be removed a day or two after the first. There is seldom bleeding of any importance after the operation, but we must be careful not to cut too much outwards, for fear of injuring the important vessels. In children it is sometimes not a very easy operation, from the small size of the mouth and other causes; and chloroform, though it may be given, does not assist us much, but the

mouth gag, used for operations for cleft palate, greatly facilitates our proceedings. An instrument called the guillotine has been introduced to obviate these difficulties; but my objection to it is that it does not remove a large enough portion of the tonsil, and besides, in children, it is quite as difficult to use as the bistoury; still in some cases it has been found useful. There is no after-treatment required beyond washing the mouth with warm water, and afterwards with alum gargle, and avoiding cold.

The term *RANULA* is applied to a cystic tumour in the sublingual region. On looking into the mouth we observe that the apex of the tongue is raised, and the body of the organ carried upwards and backwards, whilst the floor of the mouth is occupied by a large prominent swelling, of a peculiar bluish tinge from distension with fluid, and covered by the mucous membrane. In some cases there is a sort of double swelling occupying both sides of the mouth; in others, the tumour occupies only one side, but often presses over beyond the middle line as it enlarges. The swelling of course interferes with the use of the tongue and mouth; the voice is harsh and croaking.

the term *Ranula*, from the sound resembling the croaking noise made by frogs. Deglutition is interfered with, and even respiration may be seriously affected; and in some cases suffocation has been threatened from rapid increase of the swelling. Considerable difference of opinion exists as to the nature of *ranula*. Some consider it a new growth, or true cystic tumour; others, enlargement of some mucous follicles. Whilst some, with whom I am inclined to agree, consider the growth to depend upon obstruction of the sublingual and submaxillary ducts, leading to gradual change in the structure of the sublingual gland, somewhat similar to the cystic alteration which we frequently see takes place in the pancreas and kidney from obstruction in their ducts. I think this is borne out by the uniformly constant position and relations of the tumour, the slightly sacculated appearance of the cavity when opened, and the double swelling we occasionally meet with. The objection to this view, that the contents are not like saliva, is not a very strong one. In all cases of affections of secreting organs the secretion becomes altered. In this case the secretion is more glairy than saliva, but it does in general contain most of its chemical constituents. The swelling is quite different in appearance from other independent cysts, with glairy or steatomatous contents, which are not unfrequent in this region, and which can be removed entirely, the cysts as well as their contents. In *ranula* we cannot remove the cyst; it is evidently part of the natural structures.

Whatever view, however, may be taken of its pathology, there is no difference of opinion as to the *Treatment*, which consists in seizing the anterior wall of the swelling with a pair of artery-forceps, and cutting out a large oval portion of the cyst, evacuating its contents, and then painting the interior of its cavity with a strong solution of nitrate of silver, or strong tincture of iodine, to cause obliteration. This plan is usually quite successful, and far safer and less painful than passing a seton through the cyst to procure obliteration, which has sometimes been had recourse to.

Earthy Concretions form in the salivary ducts of the parotid, sublingual, and submaxillary glands. The SALIVARY CALCULUS occurs most frequently in the submaxillary duct, which it obstructs and distends. It gradually compresses a part of the gland-substance, and is felt from the neck. In whatever position these concretions form, they give rise, after a time, to inflammation and suppuration; the matter bursts externally by burrowing, and when it bursts, or is evacuated by the surgeon, there result long tortuous sinuses, which lead indirectly to the concretion, and saliva continues to ooze through the openings. The irritation caused by repeated attacks of inflammation, and the continued loss of saliva, exhaust the patient. The cause may be overlooked, especially if the sufferer is otherwise of delicate constitution. In the submaxillary region the tumour caused by the concretion may be mistaken for a glandular tumour, and an operation proposed to excise it. This would be a very serious error if acted on, for between the supposed tumour and the skin there is of course a great depth of parts, including the submaxillary gland, and the facial artery and vein.

A little attention to the history of the case, and a careful examination from the mouth, would lead to a correct diagnosis. The remedy is comparatively simple. The concretion is fixed by pressure from below by an assistant, so as to render it prominent towards the mouth, and a free incision is made from the mouth through the mucous membrane directly upon the concretion, which is then easily turned out with the scoop of a director, or seized and extracted by a pair of polypus forceps. There is little thickness of parts, no vessel of any size need be divided, no external wound is left, and little or no after-treatment is required.

INFLAMMATION OF THE TONGUE.—GLOSSITIS may be excited by various causes, but the affection is sometimes apparently dependent on epidemic influences, and then assumes a very formidable character, and demands prompt and decided treatment. The



Fig. 179.

organ becomes swollen, has a tense or brawny feeling to the touch, and is of a dark brown colour, with a sense of burning heat and pain, and the mucous membrane of the cheeks and lips is swollen. The swelling increases with great rapidity, and in some cases which I have seen, when the disease was prevalent here, the tongue swelled so rapidly as to separate the teeth and nearly fill the mouth in less than twenty-four hours from the invasion of the attack. There is a considerable amount of fever, anxious expression of face, and difficulty in breathing; indeed, unless prompt measures be adopted, the swelling of the tongue and submucous infiltration of the mouth and fauces, will speedily suffocate the patient. The *Treatment* of this active form of glossitis consists in freely incising the tongue in the longitudinal direction, keeping the incisions from the middle line. The incisions are made deeply through the infiltrated texture of the tongue, and afford relief both by depletion, but especially by the escape of serous and plastic exudation, relieving the tension and swelling. The bleeding, in general, is much less than we might at first expect from incisions in so vascular an organ, but the incisions are not made so deeply into the proper texture of the organ as they seem to be. They pass into the infiltrated structure, and when the swelling subsides, the incisions, which seemed deep gashes when first made, appear as mere superficial scarifications. After the incisions have been made, tepid lotions of honey and water, with chlorate of potash or borax, should be used to allay irritation, and the chlorate of potash may be given internally with advantage. The constitutional febrile condition must be treated on general principles, and during convalescence the use of quinine is specially indicated.

CHRONIC HYPERTROPHY OF THE TONGUE is not very common. In the cases which have come under my notice, the patients have been young, and the disease had apparently been progressing slowly from childhood, the enlargement proceeding more rapidly as the patient grew up. In these cases, although the tongue was of an enormous

size, and hung over the chin, the interference with respiration was by no means such as in acute glossitis. The reason of this is, that the jaws and cavity of the mouth, and openings of the nostrils, seem to be gradually accommodated to the great alteration in the size of the tongue. Indeed, the lower jaw, in such cases, is quite altered in form, so as scarcely to resemble the human jaw. This will be seen in fig. 180. The treatment used to be excision of a V-shaped portion of the fore part of the tongue, which protruded, and this, though attended with some risk, generally answered well enough; but it could seldom be done in young children, and when done later, the deformity of the jaw was irremediable. More recently it has been found that methodical bandaging of the protruded part, if combined with the internal use of iodide of potash, is sufficient gradually to diminish the swelling. The bandaging of this unruly organ might seem difficult, but it can be done either with cotton bandage or strips of adhesive strapping, which, however, require to be renewed frequently, and the compression is more easily managed and more effectual than I could have at first believed. I certainly would not now have recourse to excision until I had given this method a fair trial.

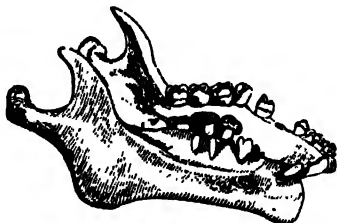


Fig. 180.

ULCERATIONS OF THE TONGUE are very common. In a great many cases they look more formidable than they really are, for they are often dependent on irritation of the gastro-intestinal mucous membrane, and in all cases their appearance is influenced by the condition of the digestive organs. In other cases the ulceration has been originally caused, and its unhealthy condition kept up, by the local irritation produced by some sharp corner of a tooth, or the fastening of some false teeth, the adjustment of which has become displaced. In the class of cases I have just mentioned the treatment is obvious—removal of the exciting cause by filing down or extraction of the offending tooth, the proper adjustment of false teeth, or leaving them out for a time till the ulcer heals, and the use of some mild wash, composed of borax, or chlorate of potash, combined with honey or glycerine and water. In more obstinate cases, the best local application is the sulphate of copper. In cases where there is a constitutional taint, such as syphilis, the appropriate constitutional remedies must of course be used; whilst in those cases where the ulcers evidently arise from, or are kept up by, derangement of the digestive function, the treatment is directed to improve that.

Unfortunately an ulcer of a cancerous nature, EPITHELIOMA OF THE TONGUE (fig. 181), is too frequently met with, and presents the usual history and character of that form of cancer. The only remedy for this is early removal by operation, and even this is not very hopeful. In speaking of epithelial cancer, I said that it was really no more

localised than any other form of cancer, and that, in patients suffering from this disease, we often find the cancer recurring, not in the part from which it has been removed, but in other parts of the body. I have removed it from the lip, and the disease has returned in the testicle, scrotum, and elsewhere: it is simply a manifestation of the cancerous diathesis. The disease is quite as much constitutional as any other form of cancer, and the structure affected merely modifies its local character.

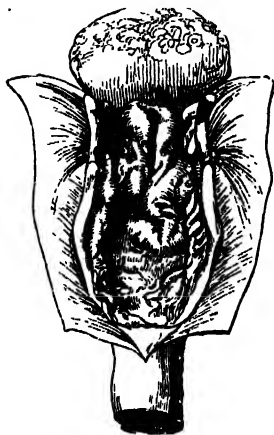


Fig. 181.

The expediency of removing the tongue for cancer will depend on the extent of the disease. If, in every case of cancer of the tongue, the disease were localised, the operation of removing the whole tongue might be warranted; but if, as I believe, it is not localised, then I think we must deal with the disease according to its extent and position. If the disease occupies a small portion of the tongue only, the best method is simply to remove it by an incision wide of the part, arresting the bleeding by torsion, or by applying the cautery to the surface. Where the tip or upper portion of the tongue is

affected, a V-shaped portion may be removed, and the parts brought together after the bleeding is arrested. This enables the patient to retain the power of speech. Or we may strangulate the anterior half of the tongue, and cut off the cancerous mass in front of the ligatures, or the operation may be effected by the *écraseur*.

The removal of one-half of the tongue, or of the entire organ, may be effected in various ways. It has been done repeatedly in Italy, and also in this country, by incisions below the jaw. The mylo-hyoid and other textures forming the floor of the mouth having been divided, and the lingual arteries exposed and tied, the tongue and os hyoides are drawn out below the jaw, the tongue is removed by dividing its attachments to the os hyoides and epiglottis. This method, whilst it avoids section of the jaw, and diminishes or almost entirely prevents the risk from blood entering the air-passages, is obnoxious to the very serious objection of detaching all the muscles which elevate the os hyoides and larynx, and consequently interferes with some of the movements of deglutition and respiration during the after-treatment. In some cases the operation has been performed by means of the *écraseur* after limited incisions of the mucous membrane of the mouth, to enable the operator to introduce the instrument, and surround the root of the tongue as far back as possible. In other cases to enable the operator to expose fully the root of the tongue an incision has been made through the cheek, from the angle of the mouth backwards, so as to have a large opening by which to introduce and arrange the *écraseur* around the part to be removed.

But whilst section of the lower jaw undoubtedly adds some risk to the operation, it enables the surgeon to expose and deal with the

diseased parts far more effectually, with less exposed cut surface, and without separation of the muscles which elevate the tongue, than any of the foregoing methods of operating. The method proceeds by section of the jaw, either for removal of the whole or one lateral half of the tongue, is the same up to a certain point. A needle, armed with a strong cord having been passed through the tongue a little behind the apex, the cord is given in charge to an assistant to enable him to draw forward the tongue when required. The operator commences by making an incision through the central line of the lower lip, down to or over the body of the os hyoides, saws through the jaw in the line of the symphysis (the incisor teeth having been previously extracted), then divides the soft parts in the mesial line, and detaches the origin of the genio-hyoglossi muscles from the jaw. The sawn ends of the jaw and the soft parts there attached, are next firmly tied with a piece of cord or narrow cotton bandage on each side, and by this means assistants are enabled forcibly to separate the lateral portions of the bone and expose the tongue and cavity of the mouth. The surgeon next divides the mucous membrane and hyoglossus muscle, first on the one, and then on the other side of the mouth, draws forward the tongue, and divides the lingual artery, which the assistant is prepared to secure at once; deals in the same way with the lingual of the opposite side, and concludes the excision by dividing the remaining attachments of the tongue. Any small vessels which bleed should be secured, and the exposed surface sponged clean and touched with a solution of chloride of zinc. The divided portions of the jaw are brought into position, and secured by drilling the bone and passing silver wire through the drill holes. One or two points are sufficient, the loop of the wire should be towards the mouth, and the ends twisted in front of the bone are brought out between the margins of the divided soft parts, which are then accurately closed by interrupted or half lip suture. The lowest part of the incision near the os hyoides should be left open, and a piece of large-sized drainage tube introduced through it into the cavity of the mouth, and fixed to the molar teeth on each side, by means of silk thread. This is a most important feature in the dressing, as it enables us to wash out the mouth with chlorate of potash or Condyl's fluid diluted, permits the free escape of discharge, goes far to obviate fætor and the risk of purulent or septic absorption, and diminishes the chance of cedematous infiltration occurring.

In some cases the lingual artery can be seen when the fibres of the hyoglossus muscle are divided, and can be secured before being cut.

Some surgeons complete this operation by dividing the tongue with the écraseur instead of the knife, so as to prevent hæmorrhage. I have hitherto always used the knife, but I believe the use of the écraseur in the latter stage of the operation would be advantageous, obviating the risk of blood flowing into the air-passages.

In cases where the disease is confined to one side of the tongue, the affected half of the organ may be removed, as the operation has frequently proved successful, and although a serious one, is not attended with the same risk to life as removal of the whole tongue. As I have already said, it is up to a certain point similar to the operation just

described, the section of the jaw, and the lip, and other soft parts in the mesial line is the same, but instead of one cord being passed through behind the apex of the tongue, two are passed, one on either side of the mesial line, and entrusted to assistants standing on different sides of the patient, so as not only to draw forward the tongue but also to render it tense from side to side when required. When the section of the jaw and lip is completed, the surgeon divides the mucous membrane of the mouth on the affected side, wide of the disease and likewise the hyoglossus muscle. The assistants having drawn forward the tongue and rendered it tense, the operator divides it, from its apex to its base, in the mesial line, and completes the excision by cutting across the base of the organ on the diseased side. The lingual artery is secured, and the other steps of the operation, dressing and after-treatment, conducted as in the operation for removal of the whole tongue.

I have said that this operation is attended with much less immediate risk to life than that for removal of the whole tongue, and the reason of this is pretty obvious. When the entire organ is removed the anterior attachments of the epiglottis, and also the muscles which project the tongue, are divided, the epiglottis and the parts about the larynx fall, or are drawn back, and when inflammatory or œdematous swelling supervene, the patient is liable to suffocation, whilst deglutition is always seriously interfered with. In my own cases I have always passed a feeding-tube through the left nostril down the œsophagus, to enable the patient to be fed, but in patients in whose cases I have only removed one-half of the tongue, the tube could generally be dispensed with on the second day, for in such cases the attachments of the tongue and its muscles to the jaw being undisturbed on the healthy side, the ordinary functions of the parts are soon restored. The patient is not only able to swallow food, but what is of no small importance, is able to gargle or wash the mouth from the discharges that would otherwise collect and become putrid.



Fig. 123.

Cases of epithelial cancer of the tongue are not very encouraging, for the operation of excision of the whole tongue is very generally fatal, and even when the patient escapes from the immediate danger, the recurrence of the disease is too often rapid. Still, from the intense suffering of the patient, the operation may be had recourse to for the great, though temporary, relief which it affords. The diagnosis of these cases is, however, very important. In a case I saw lately, the patient was suffering from what seemed to be very marked malignant disease, but which turned out to be merely a chronic syphilitic affection of the tongue. The patient recovered after tracheotomy had been performed. There was no malignant disease present, but simply a chronic

thickening and warty ulceration of the back part of the tongue.

We occasionally meet with tumours developed in the covering of the hard palate, or in the substance of the soft palate. These growths

are generally of a benign character, and of fibrous structure ; sometimes though rarely, fatty, but firmer than the ordinary adipose tumour. In many cases these palatine growths are of considerable size, and pendulous ; at other times we find the tumour embedded in the palate, but loosely connected. In either case their removal is obviously the proceeding to be adopted, and this is easily accomplished. In the case of pendulous tumours, the root of the pedicle should be included in an elliptical incision, to divide the mucous membrane of the palate around it, and then either twisted or cut out, so as to leave no portion of the pedicle. Those tumours which are embedded in the substance of the palate are removed by a longitudinal incision through the membrane of the palate directly upon the growth, which is then fixed with a sharp hook, and readily turned out with the handle of the scalpel. In cases on which I have operated I have never required to tie any blood-vessel.

NOTE.

USE OF THERMO-CAUTERY IN EXCISION OF TONGUE.

Shortly after the Second Edition was published, I had, whilst in Paris, an opportunity of witnessing the first application of Paquelin's cautery by Professor Richet in an operation on the rectum, and felt satisfied that when perfected, it would, for practical purposes, supersede the *Ecraseur* and Galvano-cautery in such operations as partial and complete excisions of the tongue. I accordingly obtained one as soon as possible, and have since then repeatedly used it in such operations, and have found it useful, in so far that it enables the operator to perform the early stages of the operation almost or altogether bloodlessly, thus averting the danger of blood getting into the air-passages during the operation ; but I never use it now to divide the lingual artery, for it almost invariably fails to arrest the bleeding from that vessel, and then the ligature is less secure against secondary hæmorrhage when the slough separates.

Let us suppose that one-half of the tongue is to be removed. The division of the soft parts and section of the jaw are effected as already described, and the portions of the jaw held widely apart. I then with the cautery divide the palato-glossal pillar of the fauces thoroughly, so as to expose the posterior part of the tongue ; after which I divide the mucous membrane connecting the jaw to the side of the tongue. These steps permit the tongue to be drawn forwards, and to the opposite side. The assistants then draw the tongue well forward, and stretch it from side to side by means of the ligature passed through its tip ; whilst the surgeon divides the tongue in the line of its raphe with the cautery knife, cutting slowly, from the base towards the apex, the knife being kept at a low red-heat. Next the genio-hyoglossus muscle is divided from the floor of the mouth to the body of the os hyoides. The operator now lays aside the cautery, and the tongue being drawn to the sound side, feels for the great corner of the hyoid bone and dissects carefully through the hyoglossus till he exposes the lingual artery, which is then tied between two ligatures and divided, the removal of the diseased part being completed by the use of a pair of probe-pointed scissors.

LECTURE XC.

INJURIES OF THE JAWS.—Fracture of the Upper Jaw—Fractures of the Lower Jaw—Causes of Displacement—Treatment—Dislocations of Lower Jaw—Method of Reduction—Diseases of the Jaws—Abscess of the Antrum of Highmore: its Symptoms and Treatment—Abscess in Lower Jaw—Epuhis—Cystic Tumours of Upper and Lower Jaws—Simple and Malignant Tumours of the Jaws—Excision of the Upper Jaw—Various Methods of performing the Operation—Excision of the Lower Jaw—Partial Resections—Disarticulation of the Lower Jaw—Excision of the Central Portion of the Lower Jaw.

THE Upper and Lower Jaws are frequently the seat of diseased conditions, which require operative procedure for their cure. The forms of disease most frequently met with in the maxillary bones or their coverings are—abscess of the antrum of Highmore in the upper jaw, or abscess in the body of the lower jawbone, with expansion of its structure; epulis, cystic and fibrous tumours, osteo-fibroma and osteoma amongst the simple growths; and the different forms of medullary tumours, from those of fibroid or fibro-plastic structure to those of true cerebriform consistence, amongst the malignant growths. Tumours of the latter class are unfortunately much more common than the simple.

FRACTURE OF THE UPPER JAW is not common, except as the result of direct force, such as a blow, or a kick from a horse. In general the injury is easily diagnosed on account of the swelling and the mobility of the alveolar process. In a case lately under my care in hospital, there was a displacement which might have given rise to a difficulty in the diagnosis. The case simulated one of dislocation of the lower jaw—the molar teeth of the upper jaw were pushed downwards, and did not correspond to those of the lower, the mouth could not be closed, and the lower jaw seemed to project. But it was merely the back part of the lower jaw which was pushed down, and on examining the parts fully, the injury was easily diagnosed and remedied. The treatment of fracture of the upper jaw is to model the parts into position as far as possible, and then to apply a bandage or handkerchief, to retain the jaws in apposition.

FRACTURES OF THE LOWER JAW are very common, and may occur at almost any point of the bone—through the angle of the jaw, for example. Not uncommonly we have a double fracture, the jaw giving way at the angle, and at a point a little to one side of the symphysis on the opposite side of the jaw, or on both sides of the symphysis. In these cases we find that the gum-texture is generally torn, so that the

fracture may almost be called a compound one; but it is not a compound fracture attended with any danger, for there is merely a slight laceration of the gum. True compound fracture of the jaw, with an external wound, is usually a very severe injury. In fractures of the jaw the teeth are generally displaced; the last molar tooth is sometimes split up, and the fragments remain in position, and we must examine for this at the time, as the sooner the split portions of the tooth are extracted the better. This should be done at first, and we should see that the fangs of the tooth are taken out, for if left in they may cause necrosis after the fracture has united.

In these, as in other fractures, the displacement is due partly to the direction of the force inflicting the injury, and partly to muscular action. When the fracture is at or near the angle of the jaw, very little displacement occurs, because the portion of the masseter muscle attached to the outer surface of the bone, and the internal pterygoid attached to its inner surface, mutually counteract each other, and maintain the fracture in position. When the fracture is nearer the chin the angle is kept pretty much in position, but the action of the mylo-hyoid tends to draw inwards the body of the jaw, and so gives rise to slight displacement. When there is a fracture near to and on both sides of the symphysis, that part, deprived of its lateral support, is acted on by the mylo-hyoid, genio-hyoglossi, and depressor muscles of the lower jaw, and displaced downwards and backwards, and there is generally considerable deformity. In fracture of the neck of the condyle, the external pterygoid being unopposed, we might expect considerable displacement, but in several cases which I have seen scarcely any deformity existed.

The *Treatment* of fractures of the lower jaw is very simple. We model the fractured portions into position, and fix the jaw by bandaging. When the teeth are tolerably complete, or even when only one or two remain in the lower jaw, if we can oppose these to corresponding teeth in the upper jaw, they serve as fixed points for applying pressure. But if the teeth are very irregular, so that we cannot do this, then we are recommended to insert some substance—say a wedge-shaped piece of cork or of gutta-percha, grooved to receive the teeth, or Nasmyth's apparatus—on each side between the jaws, to keep the lower jaw from twisting. This, however, is not often necessary. The only case in which such an apparatus is needed is when the patient has a perfect set of teeth without any having been displaced, for, under these circumstances, the patient cannot be easily fed otherwise. In most cases all that is required in the way of treatment is to keep the teeth of the upper and lower jaws fixed against each other; and this is done by applying the four-tailed split cloth or bandage round the jaw and head, as represented in plate VI., fig. 9. Formerly pasteboard splints were put on the jaw, but these are really of very little use, as there can be no counter-pressure, and the tendency to displacement is not outwards but towards the mouth.

DISLOCATIONS OF THE LOWER JAW are of two kinds—the complete or bilateral, and the incomplete or unilateral. The unilateral disloca-

tion is generally attended with greater deformity than the unilateral, owing to the open and distorted appearance of the face, and the twisting of the features occasioned by it. In bilateral dislocation there is less distortion, and the opening of the mouth might even be looked. The dislocation is generally occasioned by some violent exertion of the patient, as in yawning, or laughing immoderately. Under these circumstances the coronoid process slips forward and is fixed, whilst the condyles glide from the glenoid cavity in front of the root of the zygomatic process. There is a hollow felt at the articulation, and the line of the teeth does not correspond with that of those in the upper jaw. These conditions, together with the inability of the patient to speak, show the nature of the injury.

The method of reducing the dislocation, whether unilateral or bilateral, is very much the same. Our object is to bring down the coronoid process and condyles from where they are fixed, to allow the temporal muscle to act on the displaced bone, and this is done by raising the chin while we depress the angle of the jaw. The thumbs are placed on the last molar teeth, and the fingers under the chin. By means of the thumbs we then depress the angle of the jaw, and push it backwards, whilst the chin is tilted forwards, and in this way the dislocation is in general easily reduced. Some recommend that the thumbs should be wrapped in a handkerchief or towel, to protect them from being bitten, when the condyle becomes replaced suddenly by the powerful action of the temporal muscles. I have never seen any great necessity for this precaution, and if the operator does not take care of his thumbs, he may be none the worse of being taught by experience. The bilateral dislocation is in most cases somewhat more difficult to reduce, but still it is generally easy enough. After the reduction has been effected, we must apply a bandage, and keep the jaw fixed for some time, as this dislocation is very apt to recur when it has once happened; especially in females of a hysterical temperament, in whom dislocation of the jaw is not uncommon.

ABSCESS OF THE ANTRUM is a very common affection. The abscess is usually the result of inflammation of the lining membrane of the cavity, caused by cold, or the irritation from decayed teeth or stumps, and not unfrequently from the pivoting of artificial teeth, leading to irritation. The symptoms are intense pain and tension felt in the part, the pain very similar to toothache. There is considerable fever, then acute cedema of the cheek supervenes, and on examining from the mouth the mucous membrane is seen to be tense, and the anterior wall of the antrum is felt to bulge forwards, and has a peculiar elastic feeling to the touch. The disease is in general easily diagnosed, although, under some circumstances, it may simulate more serious disease of the upper jaw, as was the case in the child from whom the accompanying sketch was taken. In it the swelling began about eight months after birth, and had attained the size shown when the child was little more than two years old. The teeth which had appeared were irregular, the gum fungating, and the palate pressed down on the affected side. The tumour was of irregular consistence, pretty firm

generally, but of a doughy feeling at some parts. The family history was unimportant as regarded malignant growth, but the rarity of such tumours at that age made it doubtful. At a consultation I passed a bistoury deeply into the tumour, but nothing but blood escaped. Those amongst whom were the late Professor Syme and the late Mr. James Smith, who had great experience in diseases of the jaws, were all of opinion that it was a malignant tumour.

As the question of such an operation on so young a child was a very serious one, it was decided to watch the case in hospital. A few days afterwards I found the gum fluctuating near the alveolar process, and on making a puncture purulent matter flowed. I then again pushed a bistoury deeply into the tumour, and on this occasion matter gushed out. I enlarged the opening freely, and on passing my finger into the antrum I found a tooth lying loose in the cavity. This was removed. Gradually the swelling and deformity disappeared, and the little patient made a good recovery.



Fig. 183.

If the disease has occurred slowly, more in the form of chronic than acute abscess, the symptoms are modified in their intensity, and after a time pus and muco-purulent matter escape through the opening from the antrum into the middle meatus of the nose, when the patient is recumbent, and the matter is felt passing downwards. The early or palliative treatment is to remove all obvious sources of irritation, and to allay pain by anodyne fomentations to the cheek. So soon as we are satisfied that there is pus in the antrum, we should extract the tooth corresponding to the cavity, and perforate the alveolus into the antrum. This, however, is rarely sufficient. We must make an opening through the anterior wall of the cavity with a stout bistoury, and remove an oval portion of the parietes of the antrum. Thus a free escape of pus is permitted, and we can thereafter syringe out the cavity twice a day, and inject weak stimulating lotions to promote the cure.

In ABSCESS IN THE LOWER JAW, owing to the increased thickness of the bone corresponding to the purulent collection, diagnosis is often very difficult, and we must trust chiefly to the history of the case in connection with the appearance of the affected jaw. In some instances we may be obliged to make an exploratory perforation to make quite sure. In many cases the oozing of matter by the side of a tooth will guide us to the right conclusion; and if there be any decayed or loose teeth, it is advisable to remove them, and then the escape of matter will at once satisfy us of the presence of an abscess. In some instances the osseous walls of the bone expand without thickening, and become like parchment. Then the diagnosis is easy, and the treatment equally

so. An opening is made in the expanded bone with a bistoury, and a portion cut out to permit free vent for the pus. In those cases where the bone is thickened, we require to use a small trepan to perforate it. After evacuating the pus, the same treatment is adopted as in the case of abscess in the upper jaw.

EPULIS is a fibrous tumour, arising from the gum-texture, and resembling it in structure, but prominent and irregular on the surface. It is a perfectly simple growth, and generally arises in connection with irritation from decayed teeth and an unhealthy state of the alveolar process. In excising the tumour it is always advisable to remove the underlying portion of the alveolus with the cutting pliers, to ensure complete removal of the growth, and any likely source of irritation. In some cases when the tumour is merely cut off from the gum it returns. This is not due to any malignant tendency, but only because the tumour takes its origin from the periosteal covering of the alveolar process, and has not been thoroughly removed; hence the propriety of making sure by removing the portion of the process corresponding to the tumour.

CYSTIC TUMOURS OF THE JAWS are very common. In the upper jaw the cyst is generally in the antrum, and in some cases of chronic abscess of the antrum, the general appearances and symptoms are not unlike. Indeed, in many cases, suppuration in such cysts often occurs in consequence of irritation. In one case of a young woman, whose upper jaw, on both sides, was affected, I found that the cavity on the one side contained the ordinary glairy cystic fluid, whilst on the other side the antrum was distended by thin purulent matter. The cystic tumour is distinguished from the acute abscess by the absence of febrile symptoms and the acute oedema of the cheek, and by the slow and regular increase of the swelling.

The *Treatment* is very similar to that of abscess of the antrum. We open the anterior wall of the cavity, and remove a portion of it, sufficiently large to enable us to evacuate the contents of the cyst, and apply tincture of iodine or solution of nitrate of silver to the interior of the cyst, to destroy its secreting structure. The osseous walls are in general so thin, almost resembling parchment, that there is no difficulty in opening them with a common bistoury and removing an oval portion with curved scissors.

CYSTIC TUMOUR OF THE LOWER JAW is also a not uncommon affection. In some instances it is simple cystic expansion of the bone, and is usually situated near the anterior surface. In such cases all that is required is to open it up, and with a small pair of bone-pliers, cut away as much as possible of the projecting anterior wall of the cyst, and then apply nitrate of silver or chloride of zinc to destroy the remaining cystic surface. When this is done, the cavity granulates, the thickening around becomes absorbed, and the cure is completed. But if the growth return, or fungoid projections take place, or if the cystic tumour be large and multilocular, then the safest practice is to excise the portion of the jaw in which the growth is situated.

The other forms of tumour to which the jaws are chiefly subject are—osteoma, osteo-fibroma, fibrous tumours, and the different forms of malignant growths, and these present the usual characters and history of such tumours. When speaking of malignant tumours of bone I referred specially to the tumours of the upper and lower jaws in regard to their peculiarities, so that I need not dwell on them again.¹ In all the simple tumours there can be no question of the propriety of their early and complete removal, before they involve a large amount of the bone, or over-distend the skin, or become adherent to the soft parts from inflammatory action. At the same time the bulk of the tumour, supposing it to be simple, is no objection to its removal, nor does it much increase the difficulties of the operation, unless the soft parts have ulcerated from pressure, or become adherent. In the upper jaw especially, a large firm tumour, such as that represented in fig 184, is



Fig. 184

often removed with greater facility than a small one, from the amount of leverage which it affords, and because the osseous connections are thinned by the pressure of the growth. In large simple tumours of the upper jaw, in which the skin is tense, thin, and adherent over the tumour, by carefully planning our incisions it is surprising how little difficulty arises in bringing the parts into contact without overstretching them, whilst, even in extreme cases, plastic operations enable us to fill up the gap. In one case of malignant tumour of the upper jaw, which I alluded to when lecturing on malignant tumours of bone, and in which all the soft textures of the cheek required to be removed with the growth, I dissected a large flap to form a new cheek, and the patient made a good recovery at the time, although she died about two years afterwards from recurrence of the disease in the superior maxilla of the

¹ Lecture XLVIII pp 394, 395

opposite side. The appearance of the patient immediately before and after the operation, is shown in plate XXIX., figs. 1 and 2.

I shall now proceed to the operations required for the removal of such tumours.

In the lower jaw, even malignant growths, being more circumscribed anatomically, if they arise in the interior of the inferior maxillary bone, may be removed by operation with better chance of success than in the upper jaw. For in the case of tumours arising in the antrum we have not the same limitation. Very generally, in such cases, the tumour, before it shows itself towards the face, has affected the base of the cranium. Such soft growths, indeed, often arise in the ethmoid cells, and then we cannot extirpate the whole of the disease. In tumours of a more fibro-plastic character and less rapid growth, however, we may give the patient the benefit of the operation, though the growth may possibly recur. A good practical rule in regard to tumours of the upper jaw is, not to interfere when there is projection of the eyelids and eyeballs with eversion of the eye, the latter symptom especially shows that the tumour has commenced in the ethmoid bone, and is bulging outwards the contents of the orbit.

Excision of the Upper Jaw. In EXCISION OF THE UPPER JAW the lines of incision will depend entirely on the size of the tumour. Sometimes an incision made in the middle line of the upper lip will enable us to lift up the upper lip in front, and remove the tumour; for we must keep in mind that the mobility of the soft parts forming the cheek and nose, as well as the opening of the nostril, give us great space when the lip is divided, and enable us to remove a tumour of some bulk, affecting only the lower part of the superior maxillary bone. If the malar bone is diseased, or the orbit be involved in the disease, or require to be removed, the incision upwards, along the side of the nose towards the upper canthus, and are thus enabled to dissect back a flap sufficient to open the parts beyond the tumour on each side. The incisor teeth are always extracted before beginning the operation. To divide the fleshy connections, we require, after division of the soft parts, to cut through the bone at its outer attachment with the malar, then with the nasal process of the maxilla, and lastly, after dividing the soft covering of the hard palate, we introduce a narrow saw into the nostril, and saw very deeply in front through the bone. In all cases we divide the covering of the hard palate longitudinally, and the soft palate transversely out, towards the tuberosity of the jaw.

It is very rarely, however, that the superior maxilla alone is affected, and in cases such as that represented in plate XXIX., fig. 3, we require to dissect a larger flap by a rather different form of incision. We first make the same incisions as described in the preceding paragraph, and then divide the internal canthus, to separate the lower eyelid. The large flap obtained in this manner, when dissected off the bone, lays bare the entire surface of the upper jaw and malar bone, and enables us to remove a tumour of any size. We must be very careful in clearing the floor of the orbit; a thin copper spatula should be used

to guard the parts within that cavity. The malar bone is generally very dense, and requires a deep section with the saw. It is sometimes very difficult in such cases to get the soft palate divided properly, owing to the tumour being close to the teeth, and pressing down towards the tongue.

When we remove the whole of the upper jaw in this way, the wound is entirely in front of the soft palate. When all the bleeding has been arrested, some slips of lint are introduced into the large gap left by the removal of the jaw to support the cheek-flap, which is then adjusted. These slips of lint are removed in a few days through the opening in the palate. The incisions of the face generally heal by the first intention, and very little deformity is left. (See plate XXIX., fig. 2.)

Excision of the whole upper jaw and malar bone, for these large tumours, may also be effected by means of a single oblique incision through the cheek. The incision is commenced above the zygomatic process of malar bone, and carried obliquely downwards and forwards to the angle of the mouth. The soft tissues of the cheek, lip, and ala of the nose are then detached, and drawn upwards and inwards, so as to expose the body of the tumour, the nostril, and ascending or nasal process of the maxilla. The attachments of the temporal muscle in the zygomatic fossa are next separated. The soft palate and the osseous connections of the tumour are then divided, and the jaw removed as in the operations already described.

The method of operating for EXCISION OF THE LOWER JAW will depend on the nature and extent of the disease. In simple growths all that is required is to remove the tumour, together with a portion of sound bone on either side of it, for there is no tendency to reproduction in these cases. For example, if a firm tumour of a non-malignant character exists in the lower jaw, we do not require to remove the angle of the jaw or the chin, but merely to go a little beyond the tumour on each side, and complete its resection with cross-cutting pliers. Even in such cases as that represented in fig. 185, affecting the centre of the lower jaw throughout its entire depth, we do not require to remove the lateral portions of the bone, we merely require to remove the tumour, along with a small portion of the jaw on either side of it, and we may do this and leave very little deformity. In a case I operated on lately for disease of the bone, the diseased portion included nearly two-thirds of the horizontal portion of the jaw, and yet it was removed with hardly any external incision. I merely made a small incision on either side, to allow me to introduce a narrow saw to cut through the bone. The lip was then turned down without cutting it, and the mucous membrane and soft parts separated from the bone.

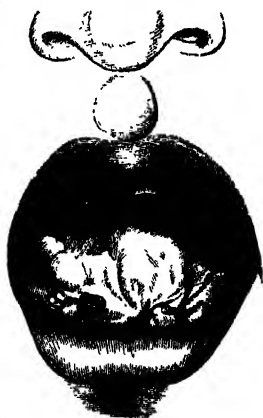


FIG. 185.

The precaution was taken to fix the point of the tongue, which might retract and turn upon itself, and suffocate the patient. In any tumour not involving the angle of the jaw, this plan may be followed out without making any large external incision, and merely leaving a small opening for the escape of the discharges from the wound, if necessary. In other cases, where we have a tumour of the lower jaw occupying nearly the whole of one side of the bone, if the tumour be at all of a doubtful character, the whole lateral portions of the jaw ought to be removed by disarticulation, because, if we leave a portion, such as the angle of the jaw, then if the disease should return, and we subsequently require to disarticulate, the difficulty of doing so becomes very great from the want of leverage, and in some cases the use of forceps to grasp the bone will not answer, as the bone is soft, and gives way under their pressure. Then we require to dissect the part out, which is both difficult and dangerous. Hence, I think, the best plan in all such cases is at once to remove by disarticulation the whole lateral portion of the jaw, at or within a short distance of the symphysis.

The operation of DISARTICULATION OF THE LOWER JAW is performed in various ways. At first it used to be done by means of an incision made from the angle of the mouth running upwards towards the zygoma, and another from the lip obliquely downwards to below the base of the jaw. The large flap so formed was dissected back, the bone then sawn through near the symphysis, the temporal muscle divided, and the bone exposed at its articulation, and readily removed. But this method left two very ugly scars across the face, and the mouth was divided at two points. Another objection was that there was no small risk of dividing the parotid duct, and it makes a great difference whether we divide the main duct or merely branches of it. In cases where the substance of the parotid gland is cut, we have a little saliva oozing out for a short time, but this disappears gradually; but when the duct is partially wounded, we find generally that the saliva makes its way out by the wound, and so keeps it open. The principal objection, however, to this method, was the great deformity left.

The method generally adopted now is to begin the incision above the articulation, and in front of the temporal artery, carrying it deeply down to the bone along the ascending ramus of the jaw, and carrying it forwards under the horizontal ramus till we come to the point where the section of the bone is to be made, and then curve it gently up towards, but without dividing, the lip.

In making this incision the facial artery should be secured before being divided, or it may be commanded by acupressure applied to the vessel below the jaw. The large flap marked out is dissected rapidly upwards and forwards, and the bone exposed. A narrow bistoury is passed towards the inner side of the jaw, so as to clear the bone, which is then sawn through to a certain extent, and divided with the bone-pliers. By using the divided ramus as a lever, the coronoid process is brought well down, to enable us to feel it, and so to divide freely the attachments of the temporal muscle. Then the jaw is turned outwards, and readily disarticulated. There is not much risk of wounding the internal

maxillary artery if we open the joint in front, and keep the edge of the knife close to the bone.

This is the plan I usually adopt, but, as regards its results, it seems questionable whether the two scars caused by the old method, or the effects of this plan, leave the worst kind of deformity. There is no scar left in this method, but there is often complete paralysis of the face, from the trunk of the portio dura being divided in the operation, which it was not in the old method. The only way to remedy this evil is to make the incision along the base, and merely curve it up slightly over the angle of the jaw in raising the flap, and then dissect very close to the bone, so as to avoid the trunk of the portio dura. This renders the disarticulation more difficult, but then there is no loss of nervous power or expression, there is less inequality in the two sides of the face, and no twisting of the features. In cases where the tumour is very large, however, we can scarcely do this, for then we require to make a very free incision to enable us to disarticulate easily and safely. After securing the bleeding vessels the line of incision is accurately closed by points of silver suture. The patient should be desired to lie on the opposite side, to prevent the saliva or discharge resting in contact with the wound.

Some details require to be specially attended to. In making our first incisions the facial artery should be ligatured if possible before being divided, for it bleeds very profusely, and may give a great deal of trouble. Of late, in excising either the lower or upper jaw, I have, with great advantage, used acupressure on the facial artery below the jaw, to command the bleeding from it both during and after the operation. The teeth corresponding to the point of section of the jaw should be extracted before the operation. The flap must be dissected up very rapidly, and the edge of the knife kept directed towards and close to the bone. The bone is cleared a little external to the symphysis, and sawn through there. We should not attempt to divide the bone with cutting pliers too soon. The saw should be made to act chiefly on the base of the jaw, which is the densest part of the bone, then the division of the bone completed by the bone-pliers. The key of the operation in disarticulating the jaw, is free and early division of the temporal muscle at the point of attachment to the coronoid process of the jaw, and then forcing the jaw outwards. In general, when, after section of the horizontal ramus we depress the jaw, the coronoid process can be readily felt, and by cutting upon and around its point, the attachment of the muscle is divided at its narrowest part. The bone should then be not only depressed, but turned horizontally outwards, to facilitate its disarticulation. In one case in which I operated for osteofibroma, the coronoid process was so altered in structure as not to be distinguishable by the finger, so I cut through all the textures with the bistoury, but finding that the point of the process still remained in the muscle left, I drew it down with a vulsellum, and removed it.

The method of excising the central portion of the lower jaw will depend on the nature and extent of the disease on account of which the operation is undertaken. I have alluded to a case in which I effected removal of the symphysis, and a large portion of the base of

the lower jaw, with scarcely any external incision—merely two small incisions to enable me to introduce the narrow saw to divide the bone on each side, and then separated the detached portion from within the mouth. But when there is a large or projecting growth, such as that shown in fig. 186, we must proceed differently. In some cases, by



Fig. 186.

means of a free incision along the inferior margin of the base of the jaw, with a little dissection we clear the lower lip from the bone, and draw it upwards, next clear the bone from its attachments on its inner surface, and saw it through on each side wide of the tumour, and so remove it. In other cases we may require to make an incision through the lip in the central line, and another at a right angle to it along the base of the jaw, reflect the flaps, and saw through the bone at each side, detach the soft parts from the inside of the jaw, and thus remove the diseased part. In some respects, so far as the manual procedure is concerned, the excision of the central portion of the jaw may seem, and indeed is, a comparatively easy operation. But, however performed, it is a very dangerous one, and the danger is

peculiar; it consists of the risk of suffocation from retraction of the os hyoides and tongue, when the attachments of the mylo-hyoid, genio-hyoid, and genio-hyoglossi muscles are divided from the bone. To avoid the immediate risk during the operation, we fix the tongue by means of a strong ligature passed through it near its tip, and held by an assistant. In most cases this suffices, as the tendency to retraction generally soon passes off. We cannot, however, trust to this, as fatal cases have occurred at a later period, and hence in all cases the ligature through the tongue should be fastened to the inside of the lip or to a silver wire stretched between the teeth on each side of the section. In a case which I recorded in 1842, where I required to disarticulate the lower jaw of a woman (plate XXX., fig. 1), in whom the opposite side of the jaw had been previously removed, I determined to leave the symphysis, to obviate the risk I have just mentioned; and, supported as it was by the old cicatrix of the soft parts, it effectually prevented it, and permitted a greater use of the incisor teeth than I had anticipated. (See Clinical Cases.)

After operations for removal of portions of the lower jaw, the use of the simple apparatus first suggested to Mr. Liston by the late Mr. Nasmyth of this city will be found of great service in preventing twisting of the remaining parts of the jaw. The apparatus consists of a case of caps fitted to the teeth of the upper and under jaw of the sound side. This is prepared before the operation, and then fitted on so as to retain the sound portion in position, and prevent twisting of the face. This apparatus is also useful, as has been already mentioned, in some cases of fracture of the jaw.

LECTURE XCI.

INJURIES AND DISEASES OF EAR—Foreign Bodies in the Ear, and Modes of Removing them—Obstruction of External Passage by inspissated Cerumen—Eczematous Affection of Auricle and Passage—Otitis—Otorrhœa—Polypi and Polypoid Growths in the External Passage—Affections of the Eustachian Tube—Eustachian Catheterism—Use of Toynbee's Artificial Membrana Tympani.

THE LIMITS of the course force me to confine myself to a general view of the more ordinary accidents and diseased conditions of the ear, which you will have to deal with in general practice.

Wounds of the external ear, or auricle, are not uncommon, but require no special treatment. In some instances the whole auricle, or large portions of it, are detached, and the result is very great impairment of hearing on the injured side. In cases where the whole auricle has been carried away the patient must have had a very narrow escape for his life. In one, which occurred in my hospital practice some years ago, a railway porter was thrown down by the tender of an engine, and his ear detached except at one point, where it was held by a thin slip of skin. This was cut through, and the patient did well; but his hearing on that side was nearly lost. I got an ear modelled in vulcanised india-rubber, to serve as a substitute; and this did assist his hearing a little. A late highly respected physician of this city, who in his youth had been an officer of light infantry, had the greater part of his ear carried away by a round shot at the battle of Waterloo; so that, in both these instances, the head must have had a very narrow escape.

We are frequently called on to remove foreign bodies which have been pushed into the external meatus. These accidents generally occur in young children, and the substances inserted are very various—small stones, peas, glass beads, and the like. Here, as in similar accidents in the case of the nostrils, abortive attempts are too often made before the little patient is brought to the surgeon, and the difficulty of removing the foreign body very much increased thereby. In proceeding to extract foreign substances from the ear, we must bear in mind the delicacy of the organ, and risk of exciting diseased action in the middle and internal ear, and the danger consequent on the close proximity to the brain, more especially in young children; for death has sometimes followed violent or ill-directed attempts at extraction. In cases where the child is brought to us before any interference has been attempted, if the substance can be readily seen, there will be no great difficulty in

removing it. The patient's head being firmly held, a small lever-scoop should be passed fairly over and beyond the foreign body, and then the handle of the curette raised, and the instrument used as a lever to tilt out the substance if impacted; or, if it be loose, the curette is merely used to draw it out. In cases where attempts have been made to extract the substance, and in which it is deeply impacted, we must proceed very cautiously, as the membrane of the tympanum may have been ruptured, and the foreign body impacted deeper in the middle ear; and I have known instances in which the promontory of the tympanum has been mistaken for the offending substance. In all such cases of impaction it is essential that the surgeon should see the foreign body; and, as the membrane of the meatus is swollen, and the passage blocked up or encrusted with blood, this must be cleared away. The first thing, therefore, that we should do, is to syringe out the passage with tepid water; this will allay the irritation and remove the coagulated blood, and then, by means of the tubular speculum, we can ascertain the presence and position of the foreign body, which the lever, or ear-forceps, may be used to remove. I have already said that no violent or haphazard efforts should be made with instruments. In some cases ~~are found~~ a stream of tepid water, forcibly injected from a syringe, succeed, when violent efforts with instruments had failed. I would advise this last-mentioned method to be used in the first instance in cases where glass beads are impacted, as these are liable to break in using the lever, and the fragments may lacerate the passage. After the foreign body is removed, if there be much irritation, the child should be kept very quiet, soft warm poultices applied over the ear, and other means used to allay the irritation, and obviate inflammatory action.

In both children and adults insects sometimes enter and lodge in the passage, or deposit their larvæ in it, and give rise to great irritation, and the cause is not suspected. When their presence is ascertained by means of the speculum, they are easily enough destroyed and removed. A few drops of tincture of iodine diffused in warm water, a little olive oil, or a very weak solution of carbolic acid injected into the ear, speedily destroys and dislodges them.

The passage of the ear is often blocked up by masses of hardened cerumen, and the patient rendered deaf in consequence of the obstruction. In such cases the ear should be syringed with a tepid solution of bicarbonate of soda, or soap and water; and if the masses of cerumen be very hard, the curette may be used advantageously to assist their removal. Thereafter a little warm oil should be dropped into the passage, and the patient taught to use a small syringe occasionally to prevent re-accumulation. In other instances an opposite condition is met with—a want of the ceruminous secretion, and dryness of the passage. After considerable experience in diseases of the ear, I believe this condition to be very rare as a cause of deafness; but it is so occasionally, and when present, the use of glycerine ointment—one part to eight of lard—will be found useful. It should be heated and applied with a hair pencil, and the passage should be gently washed out with some weak alkaline lotion from time to time.

The auricle, and the lining membrane of the external passage of the ear, are frequently the seat of a troublesome eczematous affection, attended with considerable local irritation, and which, if not checked, might lead to chronic disease of the membrane of the tympanum. The auricle and lining membrane are red and glazed, and covered with a sort of scurf or scaly coating, beneath which a thin exudation is poured out. There is intolerable itching, and occasional exacerbations of an inflammatory character. The best treatment is to apply to the parts a weak alkaline lotion, such as bicarbonate of soda, or borax dissolved in water, to which a little glycerine is added. After each application a liniment composed of olive-oil, lime-water, and glycerine, is painted on the surface. When the disease is very obstinate, a small proportion of tar-ointment may be added to the simple liniment. Internally, the use of sulphuretted waters is often of great service in promoting the cure.

INFLAMMATION OF THE EAR.—OTITIS is fortunately in most instances limited to the external ear. Owing to the nature of the structure affected, it is an extremely painful affection. The pain extends over the side of the face and head, and is aggravated by movements of the jaw, as in mastication. There is often fulness or swelling in the parotid region—redness and turgescence at the external meatus, and considerable constitutional disturbance and febrile action. In cases where the inflammation attacks the tympanum, the pain is intense, and accompanied by redness, pain, and swelling in the throat, with severe headache and sleeplessness. Occasionally the mastoid cells and the internal ear become affected, and then all the symptoms are aggravated, and the condition is a very dangerous one. Besides the symptoms already enumerated; we have pain, redness, and tension over the mastoid process and temporal bone in its vicinity, and the pain is intensified on pressure over the squamous portion of the temporal bone or the mastoid process. The constitutional disturbance is very great, and in the character of the headache, watchfulness, anxious expression of countenance, and febrile excitement, resembles symptomatic meningitis.

In the cases in which the inflammation is limited to the external ear the *Treatment* consists in applying leeches in front of the ear, or behind the auricle over the front of the mastoid process, fomenting, or applying poultices over the ear, and dropping a little warm oil and morphia into the passage, whilst the constitutional disturbance is treated by clearing out the bowels and giving anodyne diaphoretics. Not unfrequently this condition is caused or kept up by the presence of carious teeth or stumps, and the removal of these should be insisted on. When the inflammation attacks the deeper parts of the ear, the danger is very great, and our treatment requires to be energetic. If there be pain, tension, or boggy feeling over the mastoid process and temporal bone, an incision should be made over the mastoid process. This will both deplete freely and directly the parts affected, and relieve tension. Poultices should be applied to the ear, and a blister to the nape of the neck. At the same time, a moderate dose of calomel should

be given, and followed by a saline purgative to act freely on the bowels; and subsequently, antimony with opium, in small doses, to diminish the force of the circulation and to act as a diaphoretic. Should rigors occur, with feeling of increased tension, or of fulness in the ear, we should examine with the speculum; and if the membrane of the tympanum be convex and bulging, it should be incised, as purulent matter sometimes points in that direction, and an early opening may save the patient from considerable risk.

CHRONIC PURULENT DISCHARGE FROM THE EAR—OTORRHOEA is a condition very frequently met with. It may arise either as a result of acute otitis, or injury, as from the irritation originally produced by foreign bodies in the ear. Most generally, however, it arises in early life, as one of the sequelæ of children's diseases—measles, scarlatina, or whooping-cough. The subjects in whom we most frequently meet with otorrhœa are of a strumous habit; and it is always to be regarded with some anxiety, and to be carefully treated. In many cases the diseased state on which the discharge depends is limited to the external passage, and consists in chronic ulceration of its lining membrane, and a state of mere chronic irritation of that structure. This condition may continue for years, or nearly throughout a lifetime, without producing anything more serious than dulness of hearing on that side, and the annoyance caused by the discharge. In other cases, however, the middle ear and mastoid cells are the seat of disease, and the discharge is an indication of deeply-seated mischief. It has the peculiarly fœtid odour of pus generated in the neighbourhood of diseased bone, and is of variable consistence. The discharge which occurs in the otorrhœa of the external passage is generally free from fœtor, and contains a considerable amount of cuticular *débris* from the lining membrane.

In disease of the middle ear and mastoid cells, the discharge may continue for a long period without serious symptoms. There are, however, generally exacerbations of deep-seated pain, tenderness, and doughy swelling over the mastoid processes, occurring from time to time; till at last, from some slight exciting cause, such as cold, one of these exacerbations assumes a more severe and persistent form, and cerebral symptoms supervene, and terminate fatally. In such circumstances the pathological conditions found after death, such as caries of the mastoid and petrous portions of the temporal bones, disease or destruction of the dura mater, and abscess in the middle lobe of the brain, show that the disease has been long making progress towards the fatal issue.

The *Treatment* of the more superficial form of otorrhœa consists in removing all local sources of irritation, such as stumps of teeth; correcting the state of the digestive organs, and applying locally at first weak alkaline lotions, and subsequently astringent lotions of tannin, alum, or sulphate of zinc or nitrate of silver, whilst, at the same time, blisters are applied to the nape of the neck. In the deep-seated form of disease the discharge is but a symptom of more serious mischief. Our attention must be directed to improve the general health, and by inserting a seton in the neck or the application of the actual cautery,

to try and arrest the progress of the deep caries. In cases where the textures over the mastoid process are swollen, red, and puffy, an incision should be made down upon the bone. When this is done, it not unfrequently happens that unhealthy pus escapes by the wound at the time : at other times, a thin exfoliation of bone takes place, with relief of the urgent symptoms ; and, at all events, the relief of tension is followed by alleviation of the pain.

POLYPI IN THE EXTERNAL PASSAGE OF THE EAR are easily recognised, and removed by the use of small forceps, in a similar manner that we remove polypi from the nostrils. It is well to keep in mind, however, that in this situation there is peculiar soft red polypoid protrusion, which is usually connected with diseased bone, and which is rapidly reproduced after removal. It is, in fact, rather a form of polypoid granulation than a true polypus, although often assuming a regular pyriform shape. After removing such excrescences, it is well to touch the surface from whence we have removed them with red oxide of mercury, nitrate of silver, or solution of chloride of zinc, to prevent, if possible, their reproduction.

Amongst the various diseases giving rise to deafness, OBSTRUCTION OF THE EUSTACHIAN TUBE was at one time very much insisted on by specialists as a frequent cause of that infirmity, and catheterism of the tube, the eustachian air-douche, and similar operations, were very fashionable. Now, whilst obstruction of the eustachian tube undoubtedly causes imperfection in hearing, the requisite reverberation being thereby prevented, yet the causes of the obstruction are of a kind which can either be remedied by simpler measures, or in which catheterism of the tube is inapplicable. In the former class we have obstruction from swelling of the surrounding mucous membrane, or from inspissated mucus. In these conditions, catheterism of the tube would be more likely to excite irritation, and lead to organic change in structure, and so do harm rather than good. These causes of obstruction are more benefited by the inhalation of vapour, either of simple warm water, or medicated with iodine, and subsequently the free use of astringent gargles. Organic stricture of the tube is the only condition where catheterism is of benefit, and that must be a very rare condition indeed in a short mucous canal so situated as is the eustachian tube. In cases of obstruction from ulcerations of the neighbouring parts, causing contraction or obliteration of the orifice of the tube, it is needless to say that catheterism would neither be applicable nor possible. As regards the introduction of the eustachian probe, or catheter, for purposes of diagnosis, that is easily enough managed after a little practice. The instrument is made with the requisite curve, and with a flat fixed handle. The point should be very slightly bent, and the handle marked so as to indicate the direction of the point, and the distance from the orifice of the nostril to its extremity should also be calculated and marked. The instrument is passed flat along the floor of the nostril to the requisite extent ; the point should be directed upwards and outwards, whilst the handle is carried towards the septum

of the nostrils. These movements must be performed without any force. If effected gently, and used only for the purpose of diagnosis, no harm can result from catheterism; but if used on the pretext of dilating the tube, or to enable the aurist to use the air-douche or to inject medicated lotions, I hold such treatment to be not only useless but dangerous.

The membrane of the tympanum is often destroyed by ulceration, or ill-directed attempts to remove foreign bodies from the ear, and in consequence the hearing is lost, or at least much impaired. In such cases, when the acute action has ceased, and the ulceration is arrested, great benefit will be derived from the use of the artificial membrana tympani, originally devised by the late Mr. Toynbee. It consists of a small circle of membrane composed of very thin sheet caoutchouc, attached in the centre to a delicate handle composed of silver wire. In using it the surgeon should first cut the membrane to adapt it to the orifice in each case, then dip it in warm water, and pass it down through the tubular ear-speculum till it reaches the orifice of the tympanum. In many cases the improvement is immediate, but of course we cannot expect benefit in those cases where the cavity of the tympanum and internal ear have suffered in their organisation from previous disease.

The artificial membrane requires to be removed almost daily, to be kept clean, but the patients soon learn to do this for themselves.

SURGERY OF THE CERVICAL REGION.

LECTURE XCII.

SURGERY OF THE NECK—Cervical Tumours : Simple and Malignant—Cervical Hypertrophies, as those of the Thyroid Body : Importance of Careful Diagnosis in dealing with them—Adenoid and Fibro-Cystic Parotid Tumours—Fatty Tumours of the Submaxillary Region—Diagnosis and Treatment of the different Forms of Bronchocele—M. Porta's Views.
Accidental and Suicidal Wounds in the Cervical Region : their Treatment.

THERE is no region of the body of greater interest to the surgeon than that of the neck. Besides the diseases of the various natural structures which are situated in or pass through this region, it is frequently the seat of new formations, the results of either the inflammatory process or tumour growth. The great bloodvessels and important nerves which pass through the space, their branches which traverse it in all directions, and the relations of these vital structures to abscesses or tumours forming in the neck, or their displacement or impeded function by such new formations, are subjects of the greatest importance in reference to diagnosis and operative procedure in treatment.

The nature and treatment of the wounds and other injuries in the cervical region, and especially those involving the air-passages, or the pharynx and gullet, will also demand your most serious attention, and require you to bear in mind not merely the relative anatomy of the parts, but the functions they perform.

I have already, when lecturing on aneurism and ligature of arteries, brought under your notice the diagnosis of diseases of the arteries, of the neck, and their treatment ; and, when speaking of the local dangers of suppuration, I specially drew your attention to the dangers of deep-seated abscesses in the cervical region. We have still, however, to consider the important subjects of tumours of the neck, suicidal and other wounds occurring in this region, the injuries and affections of the air passages requiring surgical treatment, and injuries and diseases of the pharynx and gullet.

The TUMOURS which occur in the CERVICAL REGION, whether we regard them in reference to operative surgery or diagnosis, and the question of the treatment to be adopted, are undoubtedly amongst the

gravest subjects which the practical surgeon has to deal with. It is, however, impossible to do more, in a course of Lectures, than to lay down some general principles, and throw out some suggestions, illustrating them by reference to special cases. The circumstances and position of tumours vary in almost every case, and consequently the surgeon in considering their character, symptoms, and treatment, must depend, in each case, on his knowledge of the anatomy and functions of the different structures in relation to, or likely to be affected by, the tumour. The tumours we meet with in the neck, besides the important division into simple and malignant, may be subdivided into those which are new developments,—true tumours, and the enlargements or hypertrophies of natural structures, such as those of the thyroid body.

Of true simple tumours those most frequently met with are the fatty, situated most generally in the submaxillary and lateral regions of the neck, and placed superficially; the fibrous and adenoid growths, occupying usually the parotid and deep cervical regions, and having close relations to important parts. The malignant tumours are the different forms of medullary and hard cancer.

Perhaps the most important point which the surgeon has to decide, in reference to a cervical tumour, is its nature—whether simple or malignant.

Until a comparatively recent period it used to be laid down as an axiom that removal of tumours of the neck situated under the sternomastoid muscle should not be attempted; and we were directed to the failure in result when such attempts had been made; complete removal of the growths having been found impossible, and their rapid reproduction being the consequence. In a case of an enormous deep-seated tumour of the neck, which was sent to my care from Lancashire about fifteen years ago, the objections to which I have alluded were pressed against interference by the late Professor Syme, and I was referred to cases in which John Bell and Mr. Liston had been forced to leave portions of the tumours owing to their connections; but I had examined into these cases, and felt no doubt, from their history, that they were both of malignant character, and the fact that even in these cases the tumours were all but removed, I pointed out as an encouragement for operation where the tumour was of simple character, and therefore limited in its deep relations; and, relying on the character of the tumour, I decided to remove it, and did so successfully.

If the growth be, from its history and appearance, of simple character, then, however deeply situated, or however near important structures, it is not likely to involve them; and, consequently, although operations for the removal of such deep-seated tumours are perhaps the most difficult in surgery, still they may be undertaken with perfect safety and certainty of removal of the defined growth. In deep-seated malignant tumours, on the contrary, however defined or loose they may feel, there is no real definition. They are often attached by a deep pedicle to the cervical vertebræ, and involve the deep ligamentous texture between the vertebral processes, so that complete removal is impossible, and the tumour is reproduced rapidly, and, if possible, in a worse form than at first.

In other cases of cancerous tumours, there is no definition—the mass involves all the structures in its vicinity. I have already, in lecturing on tumour growths, specially dwelt on the characteristics of malignant, as distinguished from simple growths, and I contrasted the general appearance and expression of patients by sketches of two large cervical growths (Lecture XLV., plate XIII.)

Having formed your conclusions as to the nature of the growth, and decided that it is one suited for removal, you have next to consider its relation to neighbouring important structures,—how far their functions have already been interfered with, or may be interfered with during or after the operation—then to plan your incisions so as to avoid deformity or risk to important structures, and take means to obviate hæmorrhage or the entrance of air into the enlarged veins which may require to be divided. This last is a risk that might not be thought of, and therefore I direct your attention to it, for the superficial veins over large tumours, near the lower part of the neck, become enormously enlarged, owing either to the venous circulation being interrupted by the position of the tumour, or in consequence of their having to return the blood which circulates in the growth. The fascial structures over the tumour, and connected with these veins, keep their orifices from collapsing when divided, and air may enter them and prove fatal, unless the operator take care to tie them with two ligatures before division, or to compress them with needles. In regard to details, these must vary in almost every case; but, in regard to the method of examining and dealing with large deep cervical growths, I think I will be able to illustrate that best by referring you to two cases, accounts of which I published some years ago; and, as both were examples of the largest deep-seated and complicated forms of tumour, they may serve to indicate the chief points to be considered by the surgeon in such cases.—(See Clinical Cases.) I think the results of the cases I have alluded to are the best warrant for operative interference in proper cases. The danger lies in attempting removal in unsuitable cases.—(See case of J. M'G., in Clinical Cases.)

Removal of simple tumours from the parotid region has been so frequently performed, that I need hardly say more in reference to them than to remind you of the close relations of the portio dura nerve and the external carotid artery to such growths.

In some instances the tumour is so placed as to be superficial to the parotid gland, and then we can, by careful dissection, turn it out of its nest of condensed cellular tissue, without injuring the nerves. But in many cases the growth is developed from below, and compresses and partly adheres to the parotid, so that it is impossible to spare all the branches of the nerve. Indeed, in some instances, partial paralysis of the face is present, owing to compression of the portio dura by the growth. In a case of this kind which I operated upon last winter, the paralysis disappeared after removal of the tumour. Parotid tumours are usually fibro-cystic or adenoid, with cysts; and when the cystic element predominates, or the cysts are large, great care must be taken to avoid opening them in dissecting out the growth.

Fatty tumours sometimes attain an enormous size in the sub-maxillary region. They are quite superficial, loosely connected, and can be removed with great ease and safety, even when of the size represented in the accompanying sketch (fig. 187).



Fig. 187.

The tumours of natural structures met with in the neck are chiefly those of the Thyroid Body, constituting the different forms of Bronchocele. This disease may exist as a simple hypertrophy of the gland, due to increased nutrition of its structure, the whole organ being enlarged, but its form and structure unaltered; or it may be highly vascular, so as to have a character almost erectile, and communicating a strong pulsatory feeling to the touch. The conditions just mentioned may be confined to a part of the gland, which enlarges, whilst the rest of the organ remains of its natural size, or is but little altered. In such partial enlargements, when the isthmus is developed as a growth, it often interferes with respiration; and when the erectile form of enlargement is confined to one lateral lobe it has occasionally been mistaken for carotid aneurism. Cystic tumour of the thyroid is another form, and the cystic tumour may either be multilocular or a large single cyst. In the latter case the contents consist of either a clear serous-looking fluid, constituting hydrocele of the thyroid; or fluid of a dark brown colour, mixed with clots of blood, constituting hæmatocele of the thyroid. In these cystic tumours the swelling is almost invariably confined to one lateral lobe, or to a cystic projection of the isthmus.

In either the solid or cystic bronchocele, the position and general form of the swelling, together with its connection with the trachea, are in general sufficient to decide our diagnosis. If the patient be made

to swallow repeatedly a little fluid slowly, the way in which the tumour ascends and descends synchronously with the movements of the larynx and trachea, can leave us in little doubt as to its nature and relations. There are, however, tumours developed from or connected with the thyroid body, which occupy a position apparently quite away from it, and which are not very distinctly affected by the movements of the trachea during deglutition. These tumours, apparently superficial at their most prominent part, might lead to some confusion to the operator in removing them, unless he were prepared to find that they are always deep-seated over the sheath of the vessels, and that, instead of being defined and rounded, as their external appearance would indicate, they are rather pyriform, the narrow part being attached below to the lateral lobe of the thyroid. Hence they are not much affected by the movements of the rest of the gland,—yet by attentive examination they will be felt to move in such a way as to make us suspect the true connections. I have removed two large growths of this kind, and the external appearance of one of them is represented in plate XXXI., fig. 1.

The more solid forms of bronchocele, or goitre, are comparatively common, and in some mountainous countries, and in certain districts of England, the disease seems to be endemic. In many instances the thyroid enlargement attains a great size without materially affecting the functions of respiration and deglutition, although, I think, invariably affecting the general health, for such patients are usually anæmic, with prominent eyeballs and weak circulation. In other cases the embarrassment of the breathing is very great, and in some cases necessitates the performance of tracheotomy. In the cystic form, which often attains an enormous size, the air-passages are displaced laterally, and a sudden increase may threaten suffocation, as happened to a patient under my care, a notice of which will be found in the Clinical Cases.

The *Treatment* of the solid or vascular forms of bronchocele must consist chiefly in the use of discutient remedies, exhibited both externally and internally, such as blisters applied over the swelling, followed by painting the surface with tincture of iodine, and the internal use of the iodide of potassium, continued for a length of time. Under this treatment the swelling gradually, in some cases rapidly, diminishes, and a cure is effected. Various plans for excision of the thyroid body, or ligature of all the thyroid arteries, have been proposed in cases of bronchocele resisting remedial measures and interfering with respiration.

Dr. Watson has now in several cases removed the entire gland. The following is his description of the chief points to be attended to in the operation:—

“(1.) The external incision should be very free, extending from the larynx to the notch of the sternum if the tumour is large and spreads widely in a lateral direction. (2.) The vessels, arterial and venous, in the superficial incision should be secured as they are divided, to avoid any obscuration of the parts through oozing going on. (3.) The fascia should be as freely opened as the skin. (4.) The investing delicate fascial sheath of the thyroid should be left undivided until the mediate

ligature of the vessels included in their fine cellular sheath has been effected. This sheathing fascia or cellular capsule of the thyroid gland is only a prolongation of the sheath of these thyroïdal vessels. If the capsule is opened, then, in pushing aside the soft parts to disclose the outline of the tumour, this delicate sheath is apt to glide off the surface of the thyroid gland; and should this occur, the gland may readily be detached from the vessels even with comparatively gentle handling, and thus copious hæmorrhage, difficult of restraint, may be occasioned. (5.) After the mediate ligature of the thyroïdal vessels in their sheathing cellular envelope, the cellular capsule of the thyroid gland should now be opened by scratching through it in the middle line, and the attachments which still retain the goitre in its position carefully divided by means of curved and blunt-pointed scissors. There should be no tearing away of the gland—no pushing parts aside with any roughness of manipulation. (6.) Should bleeding occur, it must be recollected that it must take place within the cellular sheath of the vessel and its prolongation upon the gland in the fashion of an investing capsule, and that, if the vessels are to be tied, they should be secured along with the cellular sheath. Without this sheath these enlarged trunks will be found so fragile as to risk being cut by the ligature; while any attempt to reach the bleeding mouths will usually be balked by the infiltration by clot of this cellular envelope."

It is obvious that such an operation must be attended with some immediate risk, and should only be resorted to in cases of urgency. Very great care should be taken to avoid wound of the trachea or larynx, as blood may enter the air-passages and suffocate the patient by entering and filling the smaller divisions of the bronchi. There is also sometimes considerable loss of blood caused by the vessels retracting on division and slipping from the ligature.

Partial excisions, as in the case of the projecting tumours of the isthmus, have often been successfully performed. In performing this operation, a free incision is made in the central line of the neck, the cellular tissue connecting the sterno-hyoid and thyroid muscle is divided, and these muscles separated with the point of the finger, and held aside, so as to display the tumour. After insulating it so far, its pedicle should be transfix with a needle armed with a double ligature, so as to embrace each half of it in a ligature. When the ligatures are firmly tied, the projecting mass of the tumour is cut off. In one case, in dissecting out a tumour in this position, after detaching it with very little bleeding, I unwarily divided the small remaining portion, when profuse hæmorrhage took place from a vessel in the position of the middle thyroid; and, as it retracted towards the substernal region, it was very difficult to secure. A single ligature applied before division would have saved all the trouble. In excising the growths less directly connected with the lateral lobes of the thyroid, to which I have alluded, the principles of the operative procedure are the same as for removal of deep-seated tumours of the neck, keeping in mind our close proximity to the great vessels of the region and their branches, and also to the superior laryngeal nerve. But when the operator reaches the point of attachment to the thyroid, the best plan is to transfix and tie the

immediately adjacent part of the gland before removing the tumour. In the case of the young girl, from whom the sketch in plate XXXI. is taken, I found the tumour so apparently defined that I dissected it out; but, in reality, the texture of the thyroid, although somewhat condensed, had been cut, and I had to twist and tie a number of bleeding points, out of all proportion to the size of the cut surface. In operating on a similar case in an adult female, I transfixed and deligated the substance of the thyroid before removing the tumour, and there was no trouble in securing vessels.

The *Treatment* of cystic bronchocele will depend on whether it be a single or multilocular cystic tumour: in the former case we merely require to tap the cyst, and inject tincture of iodine, to cause its obliteration and cure. In some very large cysts we require to make an opening and counter-opening to evacuate the cyst fully, and then with a large camel-hair pencil paint the interior with tincture of iodine. In making counter-openings in such cases we require to use due caution, as the cyst underlies the sterno-mastoid, and its pressure may have displaced important parts towards the surface; but if we make a cautious examination before puncturing the cyst there is no danger. If the cyst contain dark-brown fluid, showing it to be a hæmatocele, and if the contents be homogeneous, the same treatment as for simple hydrocele will be sufficient; but if there be clots, or, if after the fluid has been removed, the bulk of the cyst is not much diminished, the aperture made by the trocar should be enlarged, so as to admit the finger, and if it be filled with coagula, the incision should be still further enlarged, the clots turned out, and the interior painted with iodine, or with tincture of matico if there is any oozing of blood. In operating on a case of this kind, on one occasion, after turning out the coagula, there was no oozing of blood at the time, but shortly afterwards smart oozing occurred, and I required to stuff the cavity with lint, dipped in a weak solution of perchloride of iron, to arrest it. Bleeding recurred about ten days afterwards, but was easily arrested by cold, and the girl made a good recovery. Hæmorrhage, but more repeated and troublesome, also occurred in the case of a young man on whom I had performed a similar operation. He ultimately did well. But I have known a case in which uncontrollable bleeding following an operation on a hæmatocele of the thyroid proved fatal. I do not, however, think perchloride of iron a very safe styptic in such a vascular organ, lest embolism or thrombosis take place in consequence of small clots being carried into the circulation.

M. Porta has proposed that in multilocular cysts, and even some more solid forms of thyroid tumours, we should enucleate cysts or portions of the structure by making incisions into the gland. He founds his plan on the ground that the great vessels of the thyroid body ramify on its surface, not in the interior, and that if we avoid these large vessels the enucleations can be effected without risk of hæmorrhage. I cannot, however, with the recollection of what I have seen in operations for hæmatocele of the thyroid, recommend this method as free from the danger of bleeding. It is quite true that the main vascular trunks principally ramify on the surface of the gland, but their minute ramifications are in

the interior, and constitute an almost erectile tissue in the interstices of the cell portion of the gland, and it is from this texture that the risk of hæmorrhage occurs.

WOUNDS IN THE CERVICAL REGION, implicating the Throat, Oesophagus, and Air-passages, are of great importance. They may be either accidental or suicidal. The latter are generally transverse, as the suicide endeavours to cut into the air-passages. In this he generally fails, by stretching his neck, and so cutting above the larynx, while he seldom or never divides the great bloodvessels. I have seen, however, a wound of the jugular, whilst the carotid was intact; and, on the other hand, I have tied the carotid for a small wound in its walls. The branches of the lingual, facial, and thyroid arteries are generally cut, while, as I said before, the main trunks are rarely injured. The lingual artery itself is seldom divided. The wound has a frightful look, large and gaping, it stretches from side to side, and there is a gurgling of air and venous blood. Bleeding must be arrested at once. The sides of the wound being compressed by the fingers, it should be cleaned of clots and mucus, so as to obtain a view of the parts. The arterics, however small, if wounded, should be ligatured, and the bleeding veins also secured by ligature. The common custom of sewing the wound is most reprehensible. The deep-seated textures cannot be expected to heal by the first intention, from the necessary movements of the parts. Mucus and blood and air get into the deeper-seated parts of the wound when it is sewn up, and lead to emphysema and unhealthy action. Purulent matter infiltrates and distends the tissues, so that the patient dies either from suffocation or purulent infection. Even when the wound does not pass so deeply, it should not be stitched, as blood or pus is certain to accumulate and complicate recovery. In all cases, therefore, while we may sew the angles, the centre of the wound should be left open. We must, however, take means to prevent the edges of the skin becoming inverted during the healing process.

The patient's mental and physical condition materially influences the progress of cure, and often complicates the treatment of the case, and the patient often dies, even when the wound is all but healed. Should the pharynx or oesophagus be wounded, it is necessary to nourish the patient by a tube passed through the nostrils. The instrument, however, should be passed as seldom as possible, because, in the wounded state of the pharynx, its introduction is difficult, while there is a danger, during the struggles of the patient, of its passing into the posterior mediastinum. When it is impossible to pass the instrument by the nostril, the patient must be fed by passing the tube by the mouth, or by the wound itself. The latter, if possible, must be avoided, as it keeps the wound open and causes great irritation.

Suicidal wounds, leading to inflammation and cedema glottidis, often require tracheotomy. The operation is peculiarly difficult, as the larynx is dragged downwards to the sternum, while, by stretching the head and neck backwards we gain no advantage, we only make the wound gape more widely. The upper part of the larynx should therefore be fixed with a sharp hook, and drawn upwards and forwards, as

nearly as possible into its natural position, before proceeding with the opération.

The general after-treatment must be determined by the particular symptoms and conditions of the patient in each case. The general indications are to allay irritability and procure sleep by the exhibition of opiates, and large doses of bromide of potassium, whilst at the same time the nutrition of the patient is maintained.

LECTURE XCIII.

INJURIES OF THE LARYNX—Circumstances which regulate their Severity—Primary and Secondary Dangers—Foreign Bodies in Larynx—Variety and Intensity of accompanying Symptoms, as regulated by character of Impacted Body—Sensibility of different parts of the Mucous Surface—Illustrative Cases—Tracheotomy—Special Hints regarding the Administration of Chloroform in the Operation—After-Treatment of Wound—Other Methods of causing the Ejection of Foreign Bodies—Accidents arising from the swallowing of Boiling or Acrid Fluids.

WE now pass on to the consideration of **INJURIES AND DISEASES OF THE AIR-PASSAGES**. As these are of great importance and require prompt and decided surgical interference, the student should make himself familiar with all their details, and especially with those circumstances which indicate the necessity for having recourse to the operations of tracheotomy or laryngotomy.

In this important department great advances have been made, both in regard to diagnosis and to treatment. The use of the laryngoscope in cases of chronic or subacute disease of the larynx, and for enabling us to ascertain how far the symptoms depend on organic changes, or merely on paralysis or spasm affecting the vocal cords from diseased innervation, or for discovering the position of small foreign bodies entangled in the larynx, or of intralaryngeal growths, is an invaluable accession to diagnosis, and also in determining the question of operation and plan of procedure in different circumstances.

The operation of tracheotomy has also been extended to a class of cases in which it was formerly considered unsuitable; and new operations, such as the partial or even complete excision of the larynx, have been successfully performed; Professor Billroth has reported a case of excision of the entire larynx, after which an artificial substitute was adapted, which enabled the patient to speak and read intelligibly.

Having had a very considerable experience in operations on the air-passages for injury or disease, I desire to make a few brief general remarks on some practical points, in regard to injuries and accidents affecting the air-passages, before speaking of them in detail.

There are some conditions not sufficiently insisted on in surgical works as to their dangers, or the practice to be adopted, where action requires to be prompt. Thus the danger from emphysema of the loose connective tissue of the neck is seldom adverted to; and yet I have seen a patient all but suffocated from this cause from a small oblique wound of the larynx inflicted with a penknife. In that case I had to perform laryngotomy, and was obliged to make numerous incisions to afford relief;

when a simple enlargement of the wound, in the first instance, would have allowed the air to escape externally. Again, in tracheotomy for the removal of foreign bodies, it is generally considered unnecessary to use a tube after the foreign body has been expelled, but merely to allow the incision to close at once. The consequence is that a good deal of trouble often results, for the wounds in the trachea and the superimposed parts do not correspond, and air and mucus escape into the cellular tissue, sometimes giving rise to considerable emphysematous swelling of the neck, and often leading to deep-seated irritation of the wound. In my own operations, after removal of foreign bodies, I insert a tracheotomy tube, and retain it until the surface of the wound is glazed by the effusion of lymph; and then gradually approximate the margins of the wound by strips of plaster, so as to avoid all risk of confinement of air or mucus in the tissues in the vicinity of the trachea.

Another point of importance is the question of exhibiting anæsthetics in operations for removal of foreign bodies. Many years ago I drew attention to this, and pointed out that when the foreign body was loose in the trachea or bronchus, the exhibition of anæsthetics interfered with the force of the expulsive powers which usually eject the foreign substance; and, as happened in one of my own cases, the foreign body may be carried back by the incoming current of air, occlude the bronchus, and cause collapse of the corresponding lung. In other cases, as when the body is impacted in the bronchus or larynx, anæsthetics are most useful in enabling us to search for and remove the foreign substance. In doubtful cases, the rule should be to open the trachea without using anæsthetics; and if the foreign body be not expelled by the natural forces, then to administer chloroform to enable us to deal with it effectually. When, as in the case I have alluded to, a foreign body, such as a plum-stone, is impacted, and fairly occludes the bronchus, being carried before the inspired air, it follows that the lung beyond being collapsed, there is no force behind to eject the substance. In such circumstances it is well to avoid trying too much to displace it by means of bent probes or other instruments, unless the end of the instrument can be passed over and beyond the body, so as to tilt it out, or allow air to pass to the lung beyond. Our continued efforts, besides exciting local irritation, are very likely to impact it more thoroughly; and I would therefore counsel the surgeon to abstain from useless efforts, and allow the patient to breathe by the sound lung, and wait the loosening of the foreign body by the vital dilatation caused by its presence, when air will gradually pass beyond and expel it.

In hollow or tubular foreign bodies, the case is different; they can be easily removed if we take the proper method—one which I practised some thirteen years ago, in a case where the trachea-tube had slipped down and become impacted in the left bronchus. Instead of trying to open the forceps and seize the edges of the tube, I passed the forceps closed into the tube, and then, on expanding the blades and maintaining them expanded, the foreign body was withdrawn with the utmost facility.

INJURIES OF THE LARYNX are of different kinds, and may arise

from blows, or from falls upon the box of the larynx, or from compression, as in manual strangulation. In young subjects the cartilages of the larynx are very soft and pliable; and whilst they may, by direct violence, be pressed against each other for a time, so as to prevent breathing, still their natural elasticity causes the parts to regain their normal form immediately after the pressure has been removed. In persons at middle life, however, the cartilages are strong and resistant, possessing both elasticity and absolute strength, so that they are not easily compressed by direct force. The cases where there is most risk of injury to the larynx are either those of young subjects, for the reason stated, or those of persons rather advanced in life, where the cartilages are beginning to undergo ossification. When the cartilages are completely ossified they acquire a certain amount of resistance, and are not likely to yield to an ordinary degree of force; but when they are beginning to undergo that change they are of an irregular consistence, and therefore yield unequally. In the latter condition a blow, or pressure with the hand, as in manual strangulation, may give rise to fracture—by causing separation of the fibro-cartilaginous from the ossified portion—and so lead to obstruction of the passage from altered form, or from bruising and inflammation of the internal lining membrane. This interferes with respiration, and frequently causes such alteration in the part as to require an opening to be made below the injured point.

The dangers arising from injuries of the larynx are therefore either primary or secondary. The primary danger is that of immediate suffocation, which may arise from the absolute crushing of the cartilages, this being most easily accomplished in young subjects where they are soft and pliable, or in persons in whom the cartilages are partially ossified. The secondary dangers may arise from bruising or inflammation of the larynx. This may occur at almost any period of life; and though there may be no positive alteration in external form, the parts may be much bruised and injured internally; in such cases effusion of blood takes place into the submucous tissue, between the mucous membrane of the larynx and the cartilages; or inflammatory exudation may come on in a few hours after the receipt of the injury; and, in either case, the respiration becomes so seriously impeded as to render it necessary for the surgeon to perform the operation of tracheotomy. If we delay, œdema glottidis may rapidly supervene and suffocate the patient, or he may be carried off by a spasmodic closure of the glottis produced by irritation of the laryngeal nerves. In all cases of injury or disease of the larynx, the presence of irritation of any kind, and the liability to spasm which attends it, are circumstances to be taken into account, for the glottis is an accurately adapted valvular arrangement, and, under such circumstances, spasm of the laryngeal muscles superadded, very readily produces suffocation. If we should see the case in time, we may do something to avert the dangers of spasm and inflammation, by the administration of ipecacuan, opium, and the inhalation of steam, or the external application of fomentations to the larynx.

The **ENTRANCE OF FOREIGN BODIES** into the larynx is a very

dangerous form of accident, and one of frequent occurrence. The danger is always in direct proportion to the bulk of the body introduced. The symptoms are very marked in the earlier stages. They are, in fact, an exaggeration of those produced by what in popular language is spoken of as a piece of food "going down the wrong way"—namely, a violent convulsive cough, immediately followed by a sense of suffocation, and a strong effort of the patient to bring all the muscles of the larynx and chest into play, so as to expel the offending substance. If the patient succeeds in doing this, the symptoms, of course, cease, but they may also pass off for a time without the danger being removed. A foreign body, such as a cherry-stone, may enter the larynx and give rise to a great deal of irritation and violent symptoms of suffocation; but if it pass down into the trachea, and thence into the bronchus, these symptoms will cease, and a period of quiescence come on, during which the patient breathes quite easily, and yet the danger has not passed away. The foreign body is still present, and when the patient begins to cough or move about, it may again be thrown up into the larynx. All the symptoms immediately return, and during one of the paroxysms the patient may be suffocated. The foreign body may even remain in the larynx itself, and yet no symptoms show themselves for a time. In one case when examining a body, I found an orange-pip, which lay in the ventricle of Morgagni, and had remained there for years, but it ultimately caused the death of the patient; for, though it produced no irritation at first, and though its presence was not suspected, it was the means of setting up disease in the larynx, which terminated in a form of Phthisis Laryngea.

When we look at the physiological conditions which give rise to the symptoms, we see how important they are as regards the diagnosis. The upper parts of the air-passages are endowed with a peculiar form of innervation, their mucous membrane being supplied entirely by the superior laryngeal nerve, the filaments of which pass down for some distance. The mucous membrane of the trachea and bronchi, on the other hand, is supplied by other branches from the vagus, which are given off lower down, and is not by any means so sensitive. The sensitive part of the mucous membrane begins at the lower surface of the epiglottis. This valve is so constructed that during deglutition its upper surface must come in contact with the food, often more or less stimulating in character, yet no irritation is produced by this in general. But let a single drop of water touch the *lower* surface of the epiglottis or mucous membrane of the glottis, and we have all the violent symptoms described above. This contrast in the sensibility of the two surfaces is explained by the difference in the nervous supply; for, whilst the upper part is supplied by branches from the glosso-pharyngeal, a nerve of the tongue, the lower surface derives its supply from the superior laryngeal, which, as already stated, is the proper sentient nerve of the larynx.

The laryngeal nerve is endowed with extreme sensibility, and acts as a sentinel to protect the air-passages from the entrance of any foreign body. Lower down the mucous membrane becomes much less irritable. If we pass a probe into one of the bronchi it gives rise to some irrita-

tion, but not to the suffocating convulsive cough which is produced by touching the larynx. This is due to the difference in the innervation of the two parts, and hence we see how a foreign body, getting into the air-passage, may at first irritate the peculiar mucous membrane of the larynx, producing spasm and suffocating paroxysms; and yet, presently, we may have a period of quiescence, owing to its having dropped from the larynx into the trachea or bronchus. The following cases will illustrate these principles:—

I was called many years ago to see a girl who had, at the same time, swallowed a cherry-stone and a plum-stone. Violent symptoms had occurred after swallowing them. A young medical man saw her at the time, and from his description I had no doubt that the stones had passed into the air-passages. When I arrived the girl was perfectly quiet, though breathing in a peculiar way, but the mother said she had always breathed so. This statement rendered the case rather doubtful; but the difficulty was still further increased by another circumstance, namely, that during one of the violent paroxysms the girl had coughed up the plum-stone, which might apparently have produced all the symptoms. Fearing, however, that the cherry-stone might also have found its way into the air-passage and be still unexpelled, I suspended her with the head downwards, and shook her, so to make it drop out if possible, but this produced no effect. There remained no difficulty of breathing, but, taking all the circumstances into account, I thought it prudent to have her removed to the hospital, where she might be carefully watched. I saw her two or three times during the evening, but she was still quite quiet, and remained so all night. Next day, however, at visit she was seized with a violent paroxysm. I immediately performed tracheotomy, and the cherry-stone was ejected through the wound.

The following case may form a contrast:—A little child, about a year old, was brought into the hospital. She had been playing with some peas, and was supposed to have swallowed some of them. On admission the child was quite quiet, and there was nothing apparently the matter with her, and it is worthy of remark that neither in this nor in the preceding case could we hear the peculiar valvular sound sometimes produced by a loose body lying in the air-passages. Tracheotomy was therefore not performed at the time, but she was carefully watched in the hospital for some days, and while there passed a few peas by stool. The mother then insisted on taking her home, thinking she was quite sure that all the peas had been evacuated; but on the very night of her removal the child died from sudden suffocation. A pea had become lodged in the air-passage, and had produced no irritation, until, in the process of swelling by the moisture, it had split into two halves, when a cough or expulsive effort had forced one of the halves into the larynx, and so induced fatal spasm. Now, in this case, had the child been left in hospital, tracheotomy could have been performed at once, and her life would in all probability have been saved.

I have seen many more cases in point, and, from what I have seen, I consider that when there is any doubt the safest plan—if there be a

good history of the case and reliable symptoms—is to perform tracheotomy as soon as possible. Opening the trachea in these circumstances is not in itself a dangerous operation, and it may be the means of saving life.

The foreign body may be either loose or impacted. When it is a portion of food that causes the symptoms of suffocation, it generally stops at the top of the air-passages, and does not pass downwards.¹ We should therefore always examine the back part of the mouth with the finger, so as to detect the presence of the mass, and remove it at once. It is generally stated that foreign bodies, passing downwards from the larynx, naturally find their way into the right bronchus. Now the right bronchus is certainly larger than the left, but its communication with the trachea is not more direct; and, in my experience of cases, where the exact position of the foreign body could be ascertained, I have found it has always been in the left bronchus. In one case—that of a little girl—while I was performing tracheotomy, the foreign body was loose, but the expulsive effort ceased just as the plum-stone appeared at the opening, and it slipped down the left bronchus, impacting itself so far down that it could not be extracted. A tube was inserted as usual into the throat, but the child was suffering from pneumonia, especially in the right lung, and died shortly afterwards.

In another case, a child was said to have swallowed a plum-stone; but no symptoms came on till the next morning, when the patient was seized with a violent paroxysmal cough. When I saw the child it was cold and moribund. I opened the trachea at once, and introduced a tube, and then the respiration became normal, and the patient began to recover; but the foreign body was evidently not expelled, though we could not discover it, for on closing the tracheal opening for a moment the difficult breathing at once returned. Bronchitis in this case soon came on, and the child died. At the *post-mortem* we found in one of the subdivisions of the left bronchus a very small plum-stone firmly impacted. The symptoms here must have been due to the reflex action of the nerves, causing spasm of the glottis, for even to the last, whenever the opening was closed, the difficult respiration was re-established. In another case, that of a man, tracheotomy had been performed, and for some reason the tube was kept permanently in. One day, when he was riding out, the shield of the tube had fallen off, and, according to the man's own account, the tube had passed into the larynx. On examining his throat I detected it in the left bronchus. He was therefore put under chloroform, by holding a handkerchief to the opening in the trachea, and the tube was extracted by means of a pair of pharynx forceps, the closed blades of which were introduced into the bronchus, and inserted into the open mouth of the tube; the blades were then opened so as to hold the tube firmly during its withdrawal.

In performing tracheotomy for loose foreign bodies, some special points are to be attended to, not only as to the mode of operating but as to the use of chloroform. If a foreign body be lying loose in the

¹ There may be exceptions to this (see Clinical Cases).

trachea, and if we expect it to be ejected by the natural expulsive efforts when the tracheal opening is made, we should give no chloroform. In the case of the girl mentioned in the preceding page, for example, I believe the expulsive efforts of nature would have forced out the foreign body had chloroform not been previously administered. In cases of impacted foreign bodies, on the other hand, where we require to use instruments for their extraction, and where the introduction of the instruments necessarily causes a great deal of irritation and convulsive cough, chloroform is of very great service, for it quiets the patient, and greatly increases the chances of success. In cases of a doubtful kind, as where a small coin or a large plum-stone has been swallowed, and may be impacted, though we hope it is not, I think we should perform the early part of the operation of tracheotomy without chloroform. If we find afterwards that the foreign body is not expelled by the natural efforts of the patient, but is impacted in the air-passages, then we may give the patient chloroform, and enlarge the opening so as to enable us to use instruments for its extraction.

Instead of using forceps, as was formerly done, for the purpose of holding aside the edges of the wound in performing tracheotomy, I use the flat ivory handle of the scalpel to separate the edges, and so afford a smooth surface to allow the foreign body to escape. Another point, and one about which little or nothing is said in surgical works, is the after treatment of the wound in such cases of tracheotomy. We should not treat the wound with the view of closing it immediately, for if we bring the edges together by plaster or by sutures the patient might be suffocated in a very few hours. The air, in such circumstances, would escape from the opening in the trachea into the loose cellular tissue of the neck, and as it would be unable to make its exit by the superficial wound, emphysema of the neck would come on, and might cause the patient's death by suffocation. In all cases, therefore, after the extraction of a foreign body, we should introduce a tracheotomy-tube into the trachea, and keep it there for from four to six hours, till lymph be effused and the wound become glazed. Not till then should the tube be withdrawn, and even then it is safer not to close the wound by sutures, but merely by slips of plaster, or it should be left to heal by secondary union.

There are other methods which have been proposed for causing the ejection of loose foreign bodies. When an individual, for example, in pretending to swallow a coin and bring it up again, allows it to get into the air-passages, it may sometimes be made to fall out if the patient be inverted and shaken: but in doing this we must always be ready to perform tracheotomy at the time. If the coin be a pretty large one, such as a shilling, it may be made to fall out by inverting and shaking the patient, because such a coin could scarcely go down into the larynx; but with a smaller coin, or such a body as a cherry-stone, the danger is greater, for smaller bodies are likely to pass lower down. When the patient is first seen, a body of this kind may be lying in the trachea or bronchus, where, as already explained, it may be producing little or no irritation; but should he be inverted and shaken it may roll downwards, so as to impinge upon the sensitive mucous membrane of the

larynx, and it is then very likely to give rise to dangerous suffocative spasm of the glottis. The surgeon should therefore never have recourse to inversion without having previously prepared himself for the immediate performance of tracheotomy in the event of dangerous spasm.

Some of the most formidable injuries of the air-passages are caused by ACCIDENTS ARISING FROM THE SWALLOWING OF BOILING OR ACRID FLUIDS.—The immediate effect of swallowing boiling water is to produce great swelling and inflammation about the upper part of the glottis—in fact, a form of acute *œdema glottidis*. Under such circumstances the upper part of the *larynx* is rapidly closed, and suffocation will ensue unless tracheotomy be speedily performed. So far as the breathing is concerned, this will afford complete relief. Subsequently, however, the inflammatory action may extend to the bronchial tubes and give rise to bronchitis, or the injury may so seriously affect the *pharynx* and *œsophagus* as to interfere greatly with deglutition. The case may then terminate fatally some days after the operation, but many lives are saved; and the surgeon's duty is therefore to perform tracheotomy early, whenever the symptoms of approaching suffocation begin to appear.

The propriety of tracheotomy in cases of threatened asphyxia from *œdema glottidis*, arising from swallowing boiling fluid or inhaling the steam of boiling water, would seem so evident as affording the only chance for life, that we would scarcely expect any difference of opinion; and yet I find it is by some considered unwarrantable, because the average results of such cases show few recoveries. Now, in the first place, I doubt if we have statistics so extensive or accurate as to warrant such a conclusion; but allowing that the recoveries are few, we see that the want of success is mainly due to the fact that these injuries implicate other structures, such as the *pharynx* or *œsophagus*, or are complicated with the shock and other conditions of general scald. If, however, in such injuries, *œdema* of the parts about the glottis threaten asphyxia, it is evident that the patient has no chance of life except by the operation; whilst no one will venture to deny that tracheotomy has, in many such cases, rescued the patient from impending death.

I do not recollect any instance in my own practice in which tracheotomy was required in consequence of *œdema glottidis* supervening upon acrid fluids, such as acids, being swallowed by adults or children, either intentionally or accidentally; but such a result has occurred, and we must therefore be prepared for it. The effect of sulphuric acid on the mucous membrane of the fauces and *pharynx* is to whiten and corrugate it, leading to its ultimate desquamation. It has not apparently the same tendency to produce swelling, as when steam or boiling water is inhaled or swallowed, but if, in any exceptional case, symptoms of suffocation should come on, tracheotomy must be performed without delay.

LECTURE XCIV.

Œdema Glottidis : its Nature and Treatment—Croup and Acute Laryngitis : Similarity of their Symptoms—Pathological Changes in the different Stages of Croup—The Physical Manifestations which accompany them—Treatment, Medical and Surgical—Indications and Arguments for and against Tracheotomy—The Proper Time for performing it.

THE DISEASES OF THE AIR-PASSAGES may be classified under the two heads of Acute and Chronic. The acute forms include Œdema Glottidis, Acute Laryngitis, and Croup or Cynanche Trachealis.

ŒDEMA GLOTTIDIS, as its name implies, consists of an enlargement or swelling of the textures around the glottis, arising from infiltration of serum or sero-purulent matter into its submucous tissue. It is

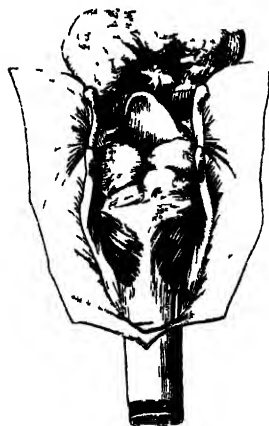


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rather the result of various kinds of diseased action than a special disease. It may arise in cases of Bright's disease, from sudden dropsical effusion into the soft textures about the glottis, or it may occur after cynanche laryngea, from effusion of serum into the loose cellular tissue about the larynx. Œdema glottidis may also come on after tonsillitis or scarlatina ; it not unfrequently follows erysipelas ; and is not by any means rare as a result of local irritation arising from mechanical or potential irritants. Thus, the accidental swallowing of foreign bodies, or of the mineral acids, or of boiling water, may give rise to it. In fact, any inflammatory affection of the larynx, tongue, or other parts in the neighbourhood, may be followed by œdema glottidis. The obstruction to the entrance of air into the lungs which it

gives rise to is entirely of a mechanical nature, being the consequence of swelling at the entrance of the air-passages. Therefore, if milder treatment fails, there can be no doubt as to the propriety of at once performing an operation such as laryngotomy or tracheotomy, which will afford complete relief to the breathing.

As regards the diagnostic symptoms of œdema glottidis, there is great dyspnoea, affecting the act of expiration after a time, as well as that of inspiration, and this apart from any disease of the chest. There are hoarseness, difficulty of articulation, and sometimes complete aphonia. On examination, by means of the finger, we feel the

epiglottis standing erect, and when we depress the tongue with a spatula we can even see it. The uvula and fauces are often cedematous. In cedema glottidis we have, after a time, a mechanical obstruction to the expiration as well as to the inspiration; but in the earlier stages we have the peculiar prolonged inspiration, with a stridulous noise, and the short and rapid expiration, as in croup or laryngitis. The diagnosis can be confirmed, if necessary, by means of the laryngoscope.

The *Treatment*, in order to be of any avail, must be prompt. In the earlier stages of the attack it has been proposed to make shallow scarifications in the uvula, epiglottis, tonsils, and surrounding textures. There is seldom, however, any time to be lost in performing these minor operations, though sometimes, at the first approach of the attack, we may snip off the uvula, and so prevent the occurrence of serious symptoms; but when the disease has fairly set in we should open the trachea without delay.

The INFLAMMATORY AFFECTIONS of the larynx and trachea arise in many cases from exposure to cold and wet, and they are accordingly most prevalent in very cold, or in damp and foggy weather. These diseases, both in their acute and chronic forms, are most common in those liable to sudden changes of temperature, such, for example, as gardeners, who are employed in hot-houses.

In children we meet with a peculiar form of laryngitis—namely, CROUP—which usually arises from exposure to cold and damp. The general symptoms of acute laryngitis and croup are very much alike, and we may therefore with advantage consider them together. There is pain in the larynx and trachea, aggravated by pressure, or by attempts at swallowing, which may lead to a sense of suffocation at the time. In general there is a good deal of cough; and in croup we have a peculiar kind of cough, with a hard ringing metallic or “brassy” sound. There is always a considerable degree of fever, and the child is restless and tosses about. The tone of voice in all cases becomes hoarse, whether in the adult or child, and sometimes there is complete aphonia. Respiration is accompanied by a peculiar stridulous sound, which becomes more marked as the disease progresses. After a time there is a suffocating cough, which comes on in paroxysms. In cases where the disease is in its advanced stage, the respiration is very peculiar and consists of a prolonged slow inspiration, with great depression of the supra-sternal fossa, followed by a short, rapid, and forcible expiration—the inspiration being accompanied by the peculiar stridulous sound. This is accounted for by the textures at the upper part of the glottis being swollen and inflamed. The movements of the glottis consequently induce spasm of the muscles, so that the passage is still further narrowed, and the air enters with difficulty. In addition to this, the mucous surfaces are roughened by the inflammatory exudation, and hence the peculiar inspiration. The expiration is short, because the expiratory muscles act violently, and the quantity of air in the lungs not being equal generally to the normal standard, its expulsion takes place with the greater rapidity.

In croup an exudation of lymph, either in a granular form or as a false membrane, is formed upon the mucous surface of the trachea as well as that of the larynx, and this distinguishes the disease from simple laryngitis. The false membrane has a great tendency to extend along the air-passages, so as sometimes to produce a complete tubular cast of the trachea and bronchi. In other cases it confines itself almost exclusively to the larynx. It may be loosely attached, or it may tend to become loose at certain points.

The formation of this layer marks the occurrence of the second stage in croup.

In the second stage of croup, therefore, when the false membrane has begun to form, we have frequently another physical symptom present—namely, a valvular sound heard immediately after expiration. This is caused by a loosened edge of the false membrane being raised by the air in expiration, and flapping down again upon the lining membrane after the air has passed out. When the tube of false membrane forms a complete cast, or when it is adherent throughout its extent, this symptom is of course wanting. From the circumstance that in croup the false membrane extends more or less into the trachea, the term *Cynanche trachealis* has been applied to the disease, but, as I will explain presently, I think this an unfortunate name, as it is apt to mislead in certain respects. In both croup and laryngitis there is a tendency to cerebral congestion and coma, owing to the imperfect aëration of the blood.

In the LARYNGITIS of adults the diseased action is generally limited to the larynx, and although attended with inflammatory infiltration and acute œdema, it does not usually terminate in superficial exudation or form a false membrane. In some cases small abscesses form in the submucous cellular tissue, or small patches of lymph are effused. The inflammatory exudation rarely passes into the trachea.

In the early stages both of croup and laryngitis, the stridulous breathing, and the suffocating paroxysms of cough, are chiefly dependent on irritation of the mucous membrane, exciting the muscles to spasmodic action, so that, combined with the swelling of the mucous membrane—even before that swelling gives rise to any obstruction to respiration—there may be obstructed respiration from spasm of the glottis, and this of itself may necessitate an operation, if the paroxysms are so violent as to threaten suffocation. This may arise long before the mere mechanical obstruction has made much progress. In most cases, then, we have, superadded to the inflammatory swelling, the irritation and danger produced by such spasms.

During the earlier stages of laryngitis in adults and of croup in children, a good deal can be done, by active *Medical Treatment*, to avert or postpone these misfortunes. General depletion will often mitigate the severity of the symptoms to a very great extent, relieving not only the local congestion, but also the distended state of the right side of the heart, and rendering the respiration much more free by its powerful antispasmodic effects. In cases of croup, blood-letting is best accomplished by opening the external jugular vein. The use of the vapour,

hot-air, or warm-water bath, is also very beneficial. A good plan, both for adults and children, is to manufacture a sort of vapour bath by rolling up heated bricks in blankets which have been wrung out of hot water, for the steam and heat so produced will make vapour form in the room or bed, and cause the patient to perspire very freely. The breathing will thus in many cases be greatly relieved. The use of other remedies also, such as mercurials, to prevent deposition or cause absorption of the lymph, acts beneficially. To allay the irritation which causes the spasms, we may give opiates cautiously, along with antimony. Sinapisms also may be applied on the chest or between the shoulders, or a blister well down upon the chest; but never apply a blister in front of the neck in such cases, as it will do no good; and if tracheotomy is required afterwards, it will have to be performed under very unfavourable circumstances. An excellent plan of treatment, in most cases, is to steam the room or bed by some such means as those already described, and to keep sponges, wrung out of hot water, constantly applied over the larynx, administering internally at the same time full doses of ipecacuanha wine, so as to keep up a degree of constant nausea.

If all these means fail we must then adopt *Surgical Treatment*, properly so called. In acute laryngitis, where the suffocating paroxysms are becoming more constant; when the cough is becoming, perhaps, suppressed, but the tendency is still present; where there is congestion of the face, and of the veins of the neck; where the chest does not distend fully and freely during inspiration; or where, instead of congestion of the face and neck, we have a pale condition of the face, with blue lips, and a slow, irregular pulse;—then the sooner tracheotomy is performed the better. The blood is not being aerated properly, and we should therefore immediately make an opening in the trachea lower down than the obstruction, whatever that obstruction be caused by. In laryngitis we have no hesitation in operating, because the disease is limited, and has no tendency to spread downwards. Whatever may be said about the propriety of performing tracheotomy in croup, no difference of opinion exists as to the necessity for the operation in the laryngitis of adults under these conditions.

In croup, on the contrary, there are conditions which have given rise to a difference of opinion. There is in it, as already remarked, a tendency in the diseased condition to spread downwards, and we are therefore told that it is not disease of the larynx but of the trachea. Now this is just a case where the name of the disease influences its treatment.

The strong prejudice against operations in croup arose, I think, from somewhat erroneous views regarding its pathology. In *post-mortem* examinations the false membranes, extending from the larynx into the trachea and bronchi, and often found in the form of complete tubular casts—a condition so different from the laryngitis of adults—led to the idea that the trachea was affected in the first instance, or at least simultaneously with the larynx, and the disease was named *Cynanche Trachealis*, in contradistinction to laryngitis. Hence most physicians and surgeons considered it improper to operate when the disease, as

they thought, was situated at and beyond the part where the aperture in the trachea could be effected.

I am quite convinced, from what I have seen of this disease, that it really commences in all cases in the larynx; and I have no hesitation in saying this, whatever tendency there may be for the disease to spread downwards from the larynx. The symptoms of laryngitis and of croup are exactly the same; there is the same suffocating cough, the same difficult respiration, the same tenderness over the larynx; and all the symptoms point to the larynx being affected from the very first. I feel convinced that in many cases of croup the disease is more confined to the larynx than is generally supposed, and that, when it spreads, it does so from the larynx downwards, and does not attack the mucous membrane of the trachea simultaneously with that of the larynx, or—as some would have us believe—attack the trachea and bronchial mucous surface before affecting the larynx. *Post-mortem* examinations reveal to us the completed disease, not its progress: our knowledge of that must be derived from observation of phenomena during life. Now, to say nothing of the ordinary progress of the symptoms, the immediate relief afforded by the operation in all my cases, even in those which subsequently terminated fatally, shows conclusively that even in the fatal cases no disease of the lower part of the trachea could have existed at the time, otherwise the operation could not have afforded the relief it did. The principal objection to operating in croup is undoubtedly the tendency of the disease to spread downwards after the operation. As to the presence of bronchitis being a contra-indication to the performance of the operation, a point which I was inclined to insist on formerly—though I would not go so far as some Continental surgeons, who consider it absolutely favourable—I must modify my former opinion, inasmuch as in most of the successful cases it was present, and when the tube was properly managed the mucus was easily expectorated. Perhaps it may be considered favourable in one sense, as indicating a condition of the mucous membrane less predisposed to the formation of plastic exudations.

We owe it to our Continental brethren, especially to Trousseau, that tracheotomy in croup has now become an established operation. I must confess that from early teaching I was strongly prejudiced against the practice; but, fortunately for me, it happened that a child was brought to me in the agonies of suffocation, so that I could not but try to relieve it. The relief was immediate, and the result successful, and thus I could not deny the like chance to others. In 1875 I had performed tracheotomy for simple croup and diphtheritic croup one hundred and three times, and saved thirty-four out of that number, or an average of about one life saved in three cases. Since then I have operated many times, but I have not kept a record of them as formerly; and it must be remembered that at first I only operated as a last resort, and even yet I do not see my way to operate quite so early as some French surgeons seem to do. I think, however, that there should be no delay when the character of the breathing and the contracted state of the thoracic parietes show that the lungs are not being distended with air. By operating early we avoid the risk of

œdema, or congestion of the lungs, and of the effects of non-oxygenised blood circulating in the brain.

We are not to perform tracheotomy on every child with a spasmodic cough in the early stage of croup, for many of them have this cough without being suffocated, and under ordinary treatment the child may get better; but in the second stage of the disease, when the false membrane is forming or has formed, we have a mechanical obstruction, and this, added to the irritation and the small size of the air-passage, justifies us in operating. Mr. Liston used to object to tracheotomy in croup, on the ground that if we operated early there was no physical obstruction of the breathing to warrant it, and that if we delayed till the symptoms were urgent, the tracheal exudation rendered the operation useless. To neither of these propositions can I assent; but I think we are hardly warranted in operating till all remedies have been actively tried without effect; then there should be no delay. Here, as in many cases, the period of the disease, as regards time, is no criterion. If, in a case of croup, depletion, the warm bath, emetics, counter-irritation, calomel, and other remedies, have been actively used without relief; if the hard ringing cough has become suppressed, and the respiration is evidently imperfect, as shown by the contracted and depressed appearance of the cartilages of the ribs and by occasional severe paroxysms of dyspnœa;—I, for my own part, would say that the operation is fully warranted. When the paroxysms become more and more frequent, or when the dyspnœa is rather persistent than paroxysmal, with turgid or pale lividity, the operation is the little sufferer's only chance for life. Another reason for performing tracheotomy is that, even in the fatal cases, the relief afforded to the patient before death is very great. I consider that the mere temporary relief from the fearful death from suffocation is sufficient to warrant us in operating; death is at least rendered more easy.

I think it right, however, to warn you that it will require some effort to bear up against discouraging results. I know of no class of cases in which the experience is so painful: an average gives little idea of it. You may have five or six cases in succession, all proving fatal, before you meet with one redeeming success; but then you have the temporary relief almost invariably afforded to the little sufferer; the resuscitations, in some cases apparently dead; and, if you persevere, the average of success will come. Above all, we must recollect that however disagreeable or unpleasant the operation may be to ourselves, we are bound to lose sight of that, and give the patient the only chance for life.

LECTURE XCV.

Diphtheritic Croup: its nature as compared with Simple Croup—Duration of Disease and Modes of Death, illustrated by Examples—Complications arising from previous Disease and present Contingencies—Indications for performing the Operation of Tracheotomy, and Cases best suited for it—Contra indications—The Stage of the Disease when it is most likely to be successful—Local and Constitutional After-treatment.

ANOTHER form of laryngeal disease which we must notice is DIPHTHERITIC CROUP.

Though experience has shown such an amount of success after the performance of tracheotomy in ordinary croup as to warrant the operation, it does not follow that in diphtheritic affections of the air-passages it would be equally warrantable. *A priori* reasoning, indeed, would almost lead to the conclusion that it is scarcely warrantable at all. All the circumstances seem unfavourable. Not only have we an equal, or even greater, tendency in the diphtheritic exudation to spread downwards, than we have in the case of the false membrane of croup, but the disease may even affect the wound caused by the operation. Moreover, it is a blood-disease of a very subtle nature, and of a most debilitating character, affecting the nervous system peculiarly, and destroying its victims by exhaustion, even when there is no laryngeal or tracheal obstruction. Yet, so far as my own experience goes, the actual results of tracheotomy in diphtheritic croup show such an amount of success, as, in the otherwise desperate state of the patient, fully to warrant its performance. I have now performed tracheotomy about fifty-three times in diphtheritic croup, and the results are rather more than one in three saved, which is slightly more favourable than in simple croup. This, however, is I believe accidental, as I do not think that these are such favourable cases for the operation as those of simple croup.

As regards the causes and mode of death in diphtheritic, as contrasted with ordinary croup, I shall, to save repetition, divide the fatal cases into two groups, according to the mode of death. Under the first head I shall arrange those who died of asphyxia, from the exudation developing itself beyond the opening in the trachea, or into the minute bronchial tubes. Of these cases one was a child, about two and a half years old, who had been under treatment for diphtheria, when urgent croupous symptoms supervened. The operation was resorted to, and was followed by great temporary relief. But next day asphyxia returned, and the child died. In another case, that of a fine

boy about eight years old, who had suffered, but was recovering, from slight sore throat, symptoms of croup supervened, and became so urgent that I was called upon to operate. This was attended with great relief, and all promised well, when diphtheritic exudation appeared, at first on one tonsil, and then gradually spread. The pulse rose, and the patient became more restless. Though the tube was kept clear, and changed several times, the breathing became embarrassed. Air passed easily out and in, and the walls of the chest seemed to expand; but it was clear, from the lividity, restlessness, and dyspnoea, that the exudation must have extended to the minute ramifications of the bronchi, thus preventing aeration of the blood. In the case of a little girl, about five years of age, the symptoms appeared after the disease had lasted for eight or ten days, and were so urgent that I operated immediately. The relief was complete at the time, and for twenty-four hours all promised well; when suddenly difficult breathing recurred. This was relieved by changing and cleaning the tube; but that gradually failed to relieve, and she ultimately died in a suffocative paroxysm, apparently from the exudation having extended downwards. Now this form of death—the extension of the mechanical obstruction downwards below the opening in the trachea—is similar to what takes place in ordinary croup.

The second and larger group of fatal cases is formed of those patients who died from the sixth to the twenty-first day after the operation, in consequence of *asthenia*, the effect of the blood-poison. In some of these there was occasionally the complication of recurring dyspnoea, though more in appearance than reality—the *jacitation* and restlessness being rather due to febrile excitement. Without detailing every case, I will select two or three typical of the conditions alluded to. The first example I select is that of a previously healthy girl of five years, a patient of Dr. Menzies. The history of the case at first was that of ordinary croup, progressing, in spite of active treatment, to threatened suffocation, for which tracheotomy was performed, with immediate relief; and for the first four days everything seemed favourable. Then the pulse became quick, but weaker, accompanied with febrile excitement. The white diphtheritic pellicle was first noticed on the pharynx on the fifth day. In the course of that day it spread over the tonsils, uvula, palate, and mucous lining of the cheeks and lips. Next, she was noticed to swallow with difficulty, part of the fluids regurgitating by the nares, and part passing out through the tube. The tube was one with a small perforation on its convex side. The pulse became more rapid, and the patient sank exhausted on the eighth day after the operation. In another case of a girl, about three and a half years old, also a patient of Dr. Menzies, I was called to operate on the third day of the croupous attack; but the child had been ailing for some days before Dr. Menzies had been called, and the diphtheritic exudation was seen over the tonsils, uvula, and palate. At the time tracheotomy at once relieved the intense suffocative symptoms. The tube was finally removed on the tenth day. There was no recurrence of difficult breathing, and I was only seeing the patient occasionally, as judging from past experience in croup cases, I thought her quite safe,

and trusted that the quick pulse and febrile state would gradually pass off. I happened to call on the eighteenth day after the operation, and found her sinking; the eyes hollow and sunk, the wound showing total want of action, and looking larger than when the tube was removed. I was told that Dr. Menzies had ordered wine and suitable nourishment; and on asking if she had taken it, the mother said, Yes; but a great part of it always came out by the wound in the neck, and by the nostrils; but she had never mentioned this to Dr. Menzies or myself. I hastened to have the child fed by the stomach-tube, but she was moribund, and died before wine or food could be administered.

As an instance of the deadly character of the blood-poison of diphtheria, independently of the mechanical obstruction to breathing, I may mention the following case:—I was sent for by Dr. Thin of Penicuik, to operate on a child residing near Eddleston. Dr. Thin told me that the symptoms preceding the laryngeal affection had been of a very low malignant character, but that the suffocative condition seemed now so bad as to demand tracheotomy to give a chance of relief. We found the child semi-comatose, with weak intermitting pulse, clammy skin, and livid countenance. I operated as speedily as possible, and thought the child would have succumbed. At first no great relief seemed to be given to the breathing, but after waiting a little, and stimulating the trachea by passing a probe through the tube, coughing was induced, and some blood, mucus, and a shred of membrane, were ejected. The breathing then became easier. After having replaced the child in bed, applied warmth, and given necessary directions, we were about to leave, when we were startled by hearing the little patient, hitherto apparently unconscious, say, with wonderful distinctness, "Gude mornin'!" I now recollected that the tube I had used was one with an opening on the convex side, so that air would pass through the larynx. I thought the strength of voice a good omen of returning power, and that possibly the former almost moribund condition of the child had depended on non-aëration of the blood; but on laying my finger on the pulse it was scarcely to be felt, the skin was as cold and clammy as before, and although the breathing had been relieved, the child died in about three hours after the operation.

These may suffice as examples of the modes of death in diphtheria after tracheotomy. As a general rule, death in cases of simple croup occurs early in the second or third day after the operation. In diphtheria life may be prolonged for two or three weeks, and death may occur by gradual exhaustion from the disease—a result either of the blood-poisoning alone, or of that combined with paralysis of the pharynx, preventing deglutition, and so interfering with nutrition; by a similar affection of the glottis—allowing fluids to enter the trachea or wound; or lastly, by the diseased action attacking the wound, and leading to phagedæna. I have also known death occur, in the case of an adult, on the second day after the operation, from paralysis of the heart, though the dyspnoea had been completely relieved.

The most formidable complications are those dependent upon the peculiar affection of the nervous system, causing paralysis of the pharynx, giving rise to the inability to swallow, or of the palate,

leading to regurgitation of food through the nostrils. These two conditions have long attracted attention ; but I am not aware that the similar affection of the glottis has been adverted to, though I have repeatedly noticed and remarked it to my medical friends. In the first case in which I saw the fluid food come through the tube, I was afraid that ulceration had occurred between the pharynx and larynx. When satisfied that such a state did not exist, I thought the phenomenon might be due to the kind of tube used, with an aperture on its convex side ; but I have found it occur equally in cases in which the ordinary tube was used. The fluid must then have passed the glottis without causing any cough, and only have been ejected when it stimulated the bronchi, or trachea below the tube. In other words, the fine sensitive nerves, which act as sentinels at the outwork of the air-passages, become paralysed, and no effort to close the glottis is made during the attempt at deglutition ; and so part of the fluid passes down the larynx and trachea, till, by stimulating the bronchial membrane, it gives rise to its own ejection through the tube or wound. This condition seems peculiar to diphtheria, for although I have now had a very large experience of tracheotomy, performed for different kinds of disease or accident, I have never seen the fluid food ejected by the tube except in that disease. I think it more important on this account, that, whilst our attention is attracted to it after tracheotomy when we see the fluid ejected, the question comes,—Is it not probable that the same paralysed state of the glottis may allow portions of fluid nutriment to pass into the air-passages in other cases of diphtheria in which tracheotomy has not been performed ?

I would now, in conclusion, state my impressions as to the propriety of performing tracheotomy in certain cases of diphtheria, or of refraining from its performance in others, derived from what I have observed in cases in my own practice.

First, then, the great and positive indication for operation is the immediate urgency of the suffocative laryngeal symptoms. When these are intense, and the contracted state of the thoracic parietes shows that little air is entering the chest, the operation is warranted, as affording the only chance of obviating impending death from asphyxia ; and this, the only chance, may be given, however unfavourable the prognosis as to ultimate success. The results of the successful cases point to the fact that the more favourable cases for operation are those in which the laryngeal symptoms have commenced early and progressed rapidly, with, perhaps, decided local diphtheritic symptoms, but the febrile or constitutional symptoms less prominent ;—where, in fact, there is least intensity of the constitutional poison, and where the very acuteness of the local symptoms indicates a certain amount of power.

The cases less suited for operation are those in which the constitutional morbid conditions have existed in a marked form, together with fever, quick and weak pulse, for some time before the exudation affected the air-passages, and in which the croupous dyspnoea is not very intense. Occasional paroxysms of convulsive cough occurring in such cases, and relieved by the ejection of mucus and false membrane, unless increasing in frequency, do not warrant the operation. ~~It is not~~

warranted in cases where, to speak generally, the colour of the face and lips, and the state of the chest, show no continued obstacle to respiration. Cases in which the diphtheritic affection has supervened on scarlatina, measles, or gastric fever, or in which there is marked sub-maxillary swelling, are very unfavourable. I have, however, seen cases recover, where tracheotomy was performed in diphtheritic croup supervening on these circumstances; so that I think we may perform the operation, though we should not urge it too much. I would not like to exclude even such cases from the benefit of the temporary relief and the chance of life which tracheotomy affords; still it is evident that the chance is very much less than in cases of uncomplicated croup, and that the results must tend unduly to reduce the average success of the operation.

In cases in which the disease has crept slowly on before the croupous symptoms began, and in which difficulty of swallowing exists, that complication seems to me a contra-indication of operation, as we can then scarcely hope to keep up the nutrition of the patient. But we must look to the exact significance of this symptom in diphtheria. In cases of acute and chronic laryngitis, as well as in croup, difficult deglutition is often a very marked symptom; but, so far from being a contra-indication to tracheotomy, it is an indication for its performance, because, in such cases, the difficulty arises from the action of the parts in swallowing exciting the laryngeal spasm. In these cases it excites cough and other symptoms of laryngeal irritation; but the dysphagia of diphtheria results from paralysis of the palate, pharynx, and neighbouring parts. There are no convulsive efforts excited to expel the food—it simply runs back, partly from the mouth, partly by regurgitation through the posterior nares; and, as we see in cases in which it comes on subsequently to the operation, part of it may pass through the larynx into the trachea. Hence I consider the presence of this condition in diphtheria most unfavourable, both as an indication of the intensity of the poison, and also and specially as presenting a difficulty to our afterwards nourishing the patient. When it comes on after the operation we must do our best to meet it by the use of the stomach tube; but I can only say that such treatment has rarely proved successful in my own cases.

Although the conditions just detailed are undoubtedly most unfavourable, I cannot, after further experience, pronounce them to be contra-indications to tracheotomy, for I have had successful results in all of them when there seemed little hope, and therefore I fall back upon my first position, that "*The great and positive indication for operation is the immediate urgency of the suffocative laryngeal symptoms.*"

Lastly, in regard to very early operation as promising greater chance of success.—Whatever the greater chances may be in ordinary croup, I can see no grounds on which we can hope for its being useful in diphtheria. Indeed, I do not think the operation warrantable until the laryngeal obstruction or spasm is well marked; because it superadds new sources of irritation and risks of its own, such as that of the disease attacking the wound; and thus the operation might deprive the patient of chances of recovery which they would otherwise have.

I trust, however, I need hardly say that I do not mean to advocate delay when the laryngeal symptoms are marked and progressing; for then unnecessary delay entails the risk of the supervention of congestion or œdema of the lungs, and so diminishes the chances of success of the operation.

In the *After-treatment* of Simple or Diphtheritic Croup, where tracheotomy has been performed, one thing ought to be attended to—namely, the form of tube—as this is important. It ought to be of such a size as will admit air freely, without over-distending the trachea, and should always be double, the inner tube fitting pretty closely, but *not* secured to the outer, either by spring or other fastening, so that it may be easily removed for cleaning, or expelled by the efforts of coughing if obstructed by mucus. The inner tube should also be long enough to pass beyond the outer one, so that we may be sure that there is no obstruction to the passage of air through it; for if the inner tube be clear, and longer than the outer one, all is right. There should be an opening in the outer or fixed tube, but never in the inner, and the latter should always be inserted when the patient takes food or drink. The tube should not be tied in too tightly, for fear of interfering with the venous circulation, and there should be no knot near it. We must of course see that the tube is introduced fairly into the trachea, though it must not be inserted too deeply.

When there is much bronchial effusion, the use of emetics in the after treatment is very beneficial; but under no circumstances would I now resort to antimony, for its effects are most dangerous in diminishing the expulsive power, depressing the patient, and inducing sinking. I am glad that my opinion on this head is strengthened by the high authority and great experience of M. Trousseau. In all respects I find ipecacuan answer better, either as an emetic or expectorant, without depressing or leading to dysenteric purging, whilst it induces moderate diaphoresis and allays the febrile condition: in many cases, when the more acute bronchial symptoms have passed, we require to give stimulant expectorants such as sal-volatile or chloric ether. The rest of the after-treatment consists in keeping the air of the room moist by letting steam pass into it near the bed: this so far moistens the mucus in the throat, and it is therefore more easily ejected through the tube. The bronchitic affections are also relieved, and simple poultices on the chest, and sinapisms on the back, are useful to allay irritation and congestion. In regard to diet, it is in many cases necessary to give beef-tea and wine from the first; but in general I prefer for the first day or two a nutrient, non-stimulating diet, such as milk and farinaceous food, and afterwards gradually give animal food; but in respect to this we must be guided by the condition of each individual patient.

In speaking of operations in croup, I have used the terms simple and diphtheritic croup, and I have done so advisedly, because, whilst the average results of my operations have been as good in the one disease as in the other, I consider them as essentially different diseases, and I do not believe that an extended experience would give the same amount of success in diphtheritic as in simple croup. It has been with no small amazement I have read some of the views recently propagated,

that croup and diphtheritic croup are identical. I can hardly conceive two diseases more different, whether we consider them in their causation, symptoms, or sequelæ. In one feature, doubtless, there is similarity, because, when in diphtheria the air-passages become affected, the presence of the membrane exuded necessarily gives rise to the same physical symptoms as to sound of voice, breathing, and asphyxiating paroxysms, as the false membrane in simple croup does. But in diphtheria the exudations in the larynx or elsewhere are the local expression of a special blood-disease, which may and often does destroy life without affecting the air-passages at all, whereas in simple croup the false membrane is the result of a local inflammation. The causes or circumstances in which the two diseases originate are, according to my experience, very different. Ordinary croup almost invariably arises from exposure to cold, or occasionally from some source of local irritation, leading directly to inflammation of the mouth, as dentition. It is most frequent during cold moist weather, and specially during the prevalence of easterly or north-easterly winds. The late Professor Alison used to say that, according to his observation amongst the poorer classes, the affection most frequently occurred between Saturday night and Monday morning; and he attributed this to the custom of washing the floors of the rooms on the Saturday night, after the children were in bed. Diphtheria, on the other hand, prevails at all seasons and during all kinds of weather—sometimes as an epidemic, and then generally coincident with scarlet fever; but always more or less connected with, or influenced by, the effects of sewage-emanations or imperfect drainage. Hence we meet with it more frequently amongst the better classes, and in houses with modern accommodations, such as fixed wash-basins and water-closet accommodation in immediate connection with nurseries or bedrooms.

Diphtheria is undoubtedly infectious both by direct contact of the sputa with a healthy mucous surface, as has been too often proved by members of our profession and by mothers, or by emanations from the affected person, as evidenced by the manner in which it spreads in a family. Simple croup, as I have been accustomed to see it, has no such contagious or infectious character. In dispensary practice I have frequently seen a child affected with croup lying in a confined room amongst other children; but I never knew the disease to spread as diphtheria does. The peculiar nervous affection, the paralysis which follows diphtheria, has no counterpart in ordinary croup; nor, in cases of simple croup, were we accustomed to see the white leathery pellicle on the tonsils or fauces, though it was a very common disease in Edinburgh and its vicinity. I know that in France the fauces were always examined, and that false membranes or pellicle were considered symptomatic of croup; but that only leads me to believe that the disease in France was always of a different type—diphtheritic, in fact.

Certainly, in this country, croup, as we used to meet with it, is rarer, whilst diphtheritic croup is more frequent, and met with under different circumstances. From 1828, until about twenty-five years later, diphtheria seemed to have ceased, though simple croup was common; but, when nearly a generation had passed away, the disease

was unhesitatingly recognised by some who had seen the previous epidemic ; and I would refer you to the interesting paper on Diphtheria and its sequelæ by the late Dr. Begbie, in his work entitled *Contributions to Practical Medicine*, in corroboration of what I say. Considering the two diseases from a surgical point of view, even in successful cases, the constitutional conditions are marked in diphtheria by paralytic complications affecting the pharynx and larynx, by albuminuria and the asthenic state of the patient, and by the tendency of the wound to take on the diphtheritic action. But it is in the fatal cases that I think the distinction between the two forms of disease is most marked by the mode of death. In a case of simple croup, the result is decided within two or three days ; indeed, generally in a shorter period, by the false membrane extending beyond the opening and tube. In diphtheria, I have on many occasions lost patients eighteen days or three weeks after the operation, and when the tube had been removed for some time, from asthenia and gradual failure of vital powers, or from paralysis of the pharynx, preventing swallowing, and so leading to imperfect nutrition ; and, in other cases, I have known it prove fatal from sudden failure of the heart's action and syncope.

I drew attention to these differences, many years ago, in a paper read before the Edinburgh Medico-Chirurgical Society, and subsequently published ; and looking back on a large experience in croup and diphtheritic croup, I think the distinctive characters are too marked to allow me to consider the diseases as identical, merely because they possess one feature in common.

LECTURE XCVI.

Chronic Laryngitis : Causes ; Symptoms ; Diagnosis ; Treatment—Warty Disease of the Larynx—Secondary and Anomalous Affections causing Laryngeal Symptoms, as Tumours of the Thyroid and Thoracic Aneurism—Symptoms common to both conditions—Value of the Laryngoscope as an aid to Diagnosis : Directions for using it—Operations of Laryngotomy and Tracheotomy in the Child and Adult : After-treatment.

THE CHRONIC DISEASES OF THE LARYNX include chronic thickening of its mucous lining arising from repeated attacks of acute or subacute laryngitis ; ulceration from the effects of tertiary syphilis ; malignant disease ; necrosis of the cartilages and perichondritis, from syphilis or other causes ; also swelling of, and sometimes a tubercular deposit in, the mucous membrane in scrofulous patients, leading to irritation and spasm, and not unfrequently to oedema glottidis.

The patient, when suffering from chronic laryngitis, may get a little fresh cold ; a sort of subacute attack supervenes—effusion from the vessels occurs into the loose cellular tissue, which, superadded to the previously existing swelling, nearly blocks up the larynx, and if irritation and spasm come on, death may result. While these chronic conditions vary to a certain extent, the immediate cause of death is generally a sudden attack of oedema glottidis. A patient so afflicted has generally, in addition to a troublesome and harassing cough, very marked symptoms of general debility. He presents a pale and sickly aspect. His lips are blanched or livid. There is often venous engorgement of the neck and arms, owing to imperfect aëration of the blood. He has a feeble and irregular pulse, often suffers from distressing breathlessness, and is frequently found to be much emaciated, especially when there is the co-existence of any tubercular disease. He complains that the paroxysms of coughing become worse at night, and that they sometimes bring on suffocating attacks of dyspnoea. In such a case we may employ the ordinary treatment—such as the application of sulphate of copper or nitrate of silver to the throat, blisters on the neck, and cod-liver oil and iodide of potassium internally ; but we cannot trust to these entirely. There is the danger that the patient may die during one of the attacks ; and if their recurrence be frequent, I would strongly urge the operation of tracheotomy. In these cases we sometimes require to keep in the tube permanently. In one hospital case I have performed tracheotomy three times successively. The tube had been taken out when it should not, and the opening in the trachea gradually closed up, requiring the operation to be again performed. The boy's ^{throat} ~~head~~, each time, improved very much after the operation.

The improvement of the general health is often very marked. I recollect a case which occurred in Professor Gairdner's practice, when Physician to the Edinburgh Royal Infirmary. I was called to see a girl in his ward who was suffering from phthisis. She was in the very last stage of exhaustion, and very much emaciated. Owing to the condition of her larynx the suffocative paroxysms had increased in frequency and severity, and hence the demand for surgical aid. I saw her during one of these paroxysms, and at once performed tracheotomy. The girl was so weak that she fainted during the operation, but from that day she began to regain strength; and within two or three months was perfectly well, and lived for several years afterwards. The marked improvement in the general health, after the operation, is itself a warrant for performing tracheotomy in these chronic affections of the larynx, to say nothing of the danger that, if it be not performed, the patient may at any moment be seized suddenly with œdema glottidis, or with suffocative spasm during a paroxysm of coughing, and die before assistance can be obtained. Hence we should perform tracheotomy in these cases, as it is the only means of completely averting the danger. We can afterwards apply our local treatment to the larynx through the wound, just as we can to any other ulcer in the body. I have had a very large experience in operating in such cases, and the results have been almost uniformly successful. I therefore strongly advise that the operation be performed when the condition is going on from bad to worse, and when the paroxysms are becoming frequent, even though they be not present when we see the patient; for when spasm is absent we can give the patient chloroform, and perform the operation easily. We may remove the tube after a little, and if necessary insert it again. The outer tube, when retained permanently, should have a hole on the convex side, so as to allow the patient to speak, but the loose inner tube should not be perforated.

At this point I would like, even at the risk of seeming to repeat myself, to impress on you very strongly the importance of tracheotomy as a remedial agent, as well as merely a means of averting suffocation in these chronic diseases. When one considers the constant movement which takes place in the larynx during ordinary respiration, and the numerous causes of irritation to which it is exposed, the intractability of many of these chronic diseases of the larynx is no longer a matter of surprise. The plain indication seems to be a wise performance of tracheotomy, by which means you gain immunity to the patient from the chance of suffocation—you give the parts rest, and put them, in their weakened state, in the best possible condition to take on a healing action. By means of the better oxygenation of the blood the whole system is put in a better condition; lastly, as already indicated, topical applications can be made from below, and as regards endo-laryngeal treatment, any one having experience of it can testify to the greater ease with which the necessary manipulations of painting or removing growths, etc., can be carried out after the trachea is opened than previous to it.

There are some cases of chronic disease of the larynx, which are comparatively rare. For example, the *Warty Disease*, in which the

diagnosis is rather difficult. The patient suspects the diseased condition sooner than the surgeon. He feels something like a small pea or seed hanging in his larynx, and there is irritation and cough. Formerly, when the diseased condition was made out, we performed tracheotomy without hesitation, and removed the excrescence; but now there may not be any necessity for the operation, as a skilful operator with the laryngoscope will generally succeed in removing them by the mouth with a pair of forceps made for the purpose, or destroy them by appropriate topical applications.

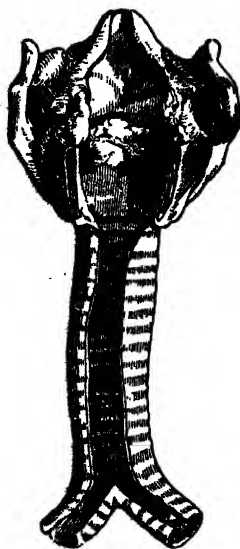


Fig. 189.

There are other conditions of an anomalous nature requiring tracheotomy. A large tumour of the thyroid body, for instance, may produce spasm of the glottis by irritating the recurrent laryngeal nerve. In one case of this kind the disease disappeared under treatment by blisters locally, and iodide of potassium internally; but after two years the patient returned with the tumour as prominent as ever. I then proposed to tap the cyst of the tumour, but before I could do this my house-surgeon was obliged to perform laryngotomy.

Another and much more frequent class of cases are those of laryngeal spasm, produced by the presence of THORACIC ANEURISM. This is an important subject, for surgeons are constantly being called upon to perform tracheotomy for aneurism of the aorta or of the innominate artery.

I desire therefore to draw attention to two classes of cases in which this operation is sometimes performed, as affording temporary relief from suffocative paroxysms or impeded respiration. I mean (1) cases of aneurism or tumours pressing upon the laryngeal nerves, and causing spasm of the glottis; and (2) aneurismal tumours of the aorta or innominate artery, impeding respiration by direct pressure on the trachea at the root of the neck. In the former class of cases I consider that the operation is not only warrantable but advisable, or even imperative, because it gives relief from impending suffocation, and also alleviates conditions which tend to increase the aneurism, or even to hasten its rupture; so that tracheotomy prolongs life with comfort to the patient. In the second class of cases (aneurismal tumours at the root of the neck, pressing directly on the trachea), I cannot see the principle on which the operation is recommended. In such cases, the tumour is lower down than where we can open the trachea; and if we use a tube long enough to pass beyond the aneurism, we are in great risk of rupturing the sac, which generally, in such cases, presses upon, and causes absorption of, the tracheal fibro-cartilages, and projects the mucous membrane. Indeed, as pathological specimens show, the tracheal textures become incorporated, as it were, with the sac, and

Fig. 189. Warty disease of the Larynx.

the aneurism generally thins and tends to ulcerate towards the trachea. Hence I cannot see how an opening in the trachea on the distal side of the impediment can relieve the breathing, whilst there is very evident risk of killing the patient by wounding the projecting and attenuated sac in opening the trachea, or rupturing it in trying to pass the trachea-tube beyond it. Here is a preparation from a case in which I made a very narrow escape from being involved in a most unpleasant predicament. I was asked to see a lady who had long suffered from bronchitis and asthmatic attacks, and in whom laryngeal symptoms seemed to indicate commencing œdema glottidis. As the medical gentleman informed me that the late Dr. Begbie, senior, had been seeing the patient, and as I understood that the laryngeal symptoms were not very urgent, I suggested that Dr. Begbie should be first asked to see the patient, and if he considered tracheotomy advisable I would come and operate. I heard nothing further until, meeting the medical attendant a day or two afterwards I inquired about the case, and was informed that after Dr. Begbie had examined the patient generally, he proceeded to examine the throat and mouth by gently depressing the tongue; this caused retching, followed by a fearful gush of arterial blood, which proved instantaneously fatal. If I had operated, the insertion of the tube could scarcely have failed to have ruptured the sac, and I leave you to conceive the situation. I think I have said enough to show that I am decidedly opposed to operation in cases of this latter class. But should any one be inclined to operate, I would advise the use of a large-sized, bulbous-pointed, soft gum catheter, with an enlarged opening, to pass beyond the tumour, instead of the metallic tube.

Huskeness of voice and a stridulous laryngeal cough are symptoms common both to such cases of aneurism and to chronic laryngitis. When there is difficulty in distinguishing between the two affections, the laryngoscope again proves most valuable, as with its aid there is observed in the one case swelling or ulceration in the interior of the larynx, and in the other nothing but paralysis or spasm of one or both of the vocal cords.

A few observations regarding the use of the laryngoscope may not be out of place in concluding this account of the injuries and diseases of the larynx.

In principle the instrument is very simple. It consists essentially of a small mirror fixed upon a stalk, so as to be capable of introduction into the back of the throat. Holding it there in such a manner as to deflect the light at the proper angle, the surgeon is enabled to obtain a good image of all the parts within the larynx. The mirrors now employed are flat, and usually circular, varying from the size of a sixpence to that of a florin, and they have the ordinary glass and quicksilver face with a metallic back. Each is fixed by its edge, at an angle of about forty-five degrees, to a stalk of soft metal, which is furnished at the other end with a wooden handle. When the operator can employ the direct rays of the sun, nothing more than this single mirror is necessary to obtain a good image of the larynx. But as we cannot always have the sun's direct rays at our disposal, it is not

that we should possess some additional means by which we ~~may~~ concentrate the light of a lamp or of a window, so as always to have a powerful illumination at our command.

The instrument, as practically used, therefore, now consists of two parts; first, of a series of the small throat mirrors, varying in size as just described; and, secondly, of a circular reflector, slightly concave, and perforated in the centre like that of the ophthalmoscope. The latter is the concentrator of the light. It is adjusted in front of the operator's right eye, or instead may throw the light from the forehead, being fixed in position by its attachment to a pair of spectacles made for the purpose, or better, perhaps, by a belt which encircles his head. The joint by which it is thus attached ought to allow considerable latitude of movement in every direction, and at the same time be stiff enough to retain the mirror in position at any angle. It is now usually made upon the ball-and-socket principle, as this is the most simple and most easily tightened when it becomes loose.

In using the instrument the operator places his lamp, which may be a good oil one, or a strong gas jet, above and slightly behind the patient's right shoulder, so that his face will be in the shade. He is then requested to put out his tongue, and to retain it so by holding the point with a handkerchief between the right forefinger and thumb. The chin, at the same time, is slightly raised, the neck stretched forwards, and the mouth well opened. In this position the operator, throwing a strong light into the throat from the large reflector, may first, at a glance, examine into the state of the mouth and fauces. He then, to prevent tarnishing with the breath, gently heats the small throat-mirror, either by placing it for an instant over the lamp, with its glass face downwards, or by dipping it in hot water. Holding it now by the stalk, like a pen, he carefully but promptly introduces it into the throat, avoiding contact with all the parts except the soft palate and uvula, against which he applies the metallic back of the mirror, pushing it gently backwards and upwards. The handle, which is held at the angle of the mouth, is at the same time slightly depressed, until the proper angle of reflection is obtained. It is well for the operator to ensure the steadiness of his hand by resting the tips of the ring and little fingers against the cheek of the patient.

The extent of the parts thus displayed varies greatly in different individuals. The epiglottis can almost always be displayed; but in the majority of instances the valve overlaps the vocal cords so much as at first to hide all but their posterior extremities from view. If, however, the patient be desired to sing a prolonged note, rather high in the scale, it will be drawn upwards, so as to expose them posteriorly to a considerable extent. The anterior extremities are rarely or never brought into view. If the patient be now desired to take a long breath, the glottis will at once be thrown open to its widest extent, and in many cases a good view may be obtained of the upper, and sometimes of the lower rings of the trachea, even down to its bifurcation.

The beginner will find the use of the instrument by no means easy, on account of the delicacy required in its manipulation; but with patience he will easily overcome most of his difficulties. It is of great

importance to make the examination deliberately, and in such a manner as not to alarm the patient. The most common difficulty arises from excessive irritability of the fauces; and this is greatly increased if the patient be excited or alarmed. It is well in all cases to pass some little time in conversation after arranging the light, so as to allow all nervousness of your patient to subside, especially as the first trial at a sitting is usually the most successful, the majority of throats becoming irritable when repeatedly touched by the mirror. There are some patients whom, owing to exceptional formation of the parts, it is impossible to examine successfully with the laryngoscope; but these are very few in number. Where irritability is so excessive as to render your first attempts futile, it is well to repeat the trial from day to day, until the throat becomes accustomed to the touch of the mirror; and in such cases it is recommended that the bromide of potassium be administered internally, in full doses, so as to allay any existing hyperæsthesia; and also the local application of bromide of ammonium in the form of a spray. In cases of great irritability of the larynx itself, a mixture of morphia-acetate of lead and sugar of milk has been found very useful, not only as a mere help to examination, but also as a valuable means of allaying pain in cases of phthisical ulceration, etc.; but of course this plan of treatment can only be adopted when the circumstances of the case will admit of delay.

In the case of foreign bodies in the air-passages, the laryngoscope is likely to prove exceedingly valuable. With its aid the surgeon is enabled to make out the exact nature and situation of the body, if it be within the larynx; and, if he be skilful in the use of the instrument, he may even succeed in extracting it with the laryngeal forceps now employed in removing polypi and other growths from the glottis. Should any circumstance in the case, however, render the trial of this method of extraction inexpedient—as, for example, great irritability of the fauces, or firm impaction of the foreign body below the level of the vocal cords—the surgeon will at least proceed with the greater confidence to operative interference when he has ascertained the exact situation in which he may expect to find it. In these circumstances, when the body is evidently in the larynx, the best treatment would be to perform the operation of laryngotomy, as by this means the surgeon cuts directly down upon the offending substance, making it visible through the incision, and of course rendering its removal extremely easy.

The operation of LARYNGOTOMY, except in its situation, is very much the same as that of tracheotomy. The superficial incision should be commenced about the middle of the thyroid cartilage, and prolonged downwards in the mesial line to the lower border of the cricoid, and the deep incision is made in the same direction through the crico-thyroid membrane into the larynx; but in order to get sufficient room, it is frequently prolonged downwards through the body of the cricoid cartilage, or the crico-thyroid membrane may be divided transversely. In the course of the operation the edges of the two sterno-hyoid muscles are separated from each other, and a few veins which lie over the larynx are to be avoided, as they may be sources of bleeding. *Some*

little hæmorrhage may also take place from the small crico-thyroid arteries, which cross the crico-thyroid membrane in a horizontal direction, but these seldom give any trouble.

I would now, in conclusion, offer a few remarks upon the more important operation of TRACHEOTOMY.

The operation of tracheotomy is one often spoken of as perfectly simple and easy, and so it is in many cases ; but even in the adult, the state of a patient struggling in the agonies of suffocation, often renders its performance by no means so simple as generally described ; and in children from three to five years of age, in whom croup is most common, it is attended with much greater difficulty, or at least requires greater caution, than in the adult. I believe success depends a good deal on the manner in which it is performed, and attention to some minutiae in its performance.

There ought to be no attempt at brilliancy in this operation ; every step should be methodically gone about. First, as regards the position of the patient, the shoulders should be well raised, the head bent moderately backwards and supported by an assistant, who should pass one arm under the pillow behind the neck, so as to project or support it forwards, whilst with the other hand he keeps the head fixed, with the chin in the middle line, as a guide to the surgeon. In children the arms and legs may be controlled by a small sheet or large towel pinned round the body, the arms placed by the side ; and when thus secured, one person can control the movements. Care should be taken to see that the teeth be not firmly closed, but that the mouth be partially open and the nostrils free.

The external incision should begin over the cricoid cartilage, and extend downwards exactly in the middle line for about two inches. If the incision be not exactly in the middle line, the trachea may be cut into laterally, and in that case it would be difficult to retain the tube afterwards, or the carotid arteries might be wounded. In general, two large veins, one on either side of the mesial line and close to it, are seen when the skin is divided ; the fascial texture between those, corresponding to the intermuscular line, is readily divided by the point of the knife, and then these veins can be easily drawn aside (plate XXXIII.) Sometimes one vein crosses the line to join the other, and may even require to be divided after being secured by ligatures : this is embarrassing ; but the point most to be attended to is caution, after separating the tracheal muscles. These muscles are separated by dividing the fibro-cellular tissue connecting the margins of the sterno-hyoid muscles, in the line and to the extent of cutaneous incision. If the finger be placed deeply in the wound at this stage, the trachea is felt pretty distinctly, and may seem so distinct as to warrant the surgeon in inserting his bistoury to divide the rings ; but I hold that this ought not to be done, because not only may there be the substance of the thymus gland flattened under the finger, but deeper, and passing from that gland to the thyroid, there exist numerous vessels which would bleed profusely. I have more than once pointed out this to the gentlemen assisting me in my operations. After separating the lobes of the thymus gland,

vessels and the thymus are removed, and I clear the trachea with the knife from loose cellular tissue, so that there may be no obstruction to the entrance of the silver tube when the opening is made in the trachea. Before opening the trachea it is advisable to fix it by inserting a small sharp hook into its upper part. In cases of croup the tube should not be introduced too quickly, as in that case it might prove an obstruction to the ejection of the false membrane. I generally keep the opening in the trachea patent by means of a double blunt hook, which I have devised for the purpose, or the handle of the scalpel, until such time as the detached shreds are coughed up. Should there be venous bleeding, however, the tube must be inserted at once. On the tube being introduced the head should be bent slightly forwards.

The description just given of the steps of the operation in children, is that which I gave in a paper read before the Medico-Chirurgical Society of Edinburgh fifteen years ago, after a very considerable experience in performing tracheotomy on children; and after a still larger experience (now, I believe, the largest of any surgeon in this country, having performed it on children one hundred and eleven times for different causes), I have nothing to alter in or add to my directions. By attending to the rules laid down, whilst all hurry should be avoided, the operation will be executed at once safely and expeditiously.

In some very extreme cases I have found it necessary to proceed very rapidly, as the infants were apparently asphyxiated, and by passing a feather down the trachea, sprinkling cold water on the face, and performing artificial respiration, I have succeeded in restoring animation; but, except in such cases, there should be no great haste.

In performing tracheotomy in the adult, whilst the general steps of the operation are the same, and whilst it is easier of execution in most cases, yet in some respects it presents difficulties peculiar to adult life. In children, the space in which we have to make our incisions is absolutely smaller than in the adult, but, relatively, the space is greater between the isthmus of the thyroid gland and the top of the sternum. The space occupied by the larynx and hyoid bone is small, and the cervical portion of the trachea is longer than in the adult. The development of the larynx in the adult alters the relation of parts;—the space between the chin and the lower margin of the cricoid cartilage is increased, whilst the space between the cricoid cartilage and sternum has diminished. The trachea is thus shorter, and not only so, but in proportion to the projection of the larynx and development of the thyroid gland, the trachea descends obliquely backwards from the surface, and its depth a little above the sternum is very considerably increased.

In the male, when the neck is short and muscular, the muscles tense, and the trachea working violently up and down, as in threatened asphyxia, the difficulties of the operation are sometimes very great.

In some cases on which I have operated I have found the trachea situated at a great depth from the surface, and so short a space between the thyroid isthmus and sternum as not only rendered the operation difficult, but, when completed, the orifice of the tracheotomy tube was

almost drawn under the sternum, and I have occasionally been obliged to fix and draw the trachea upwards by means of a sharp hook, till the convulsive movements diminished.

As the diseases which require the operation in adults have little or no tendency to spread downwards, I think that in them, and also in children for papiloma of the larynx, or such diseases, the opening in the trachea should always be made with advantage above the isthmus of the thyroid, by pushing that structure down, so as to expose the upper rings of the trachea. I have now done so in several cases, and from what I have seen of the difficulties in short muscular necks, I would especially advise this to be done when operating for laryngeal spasm depending on aneurism, particularly if there be any reason to suspect that dyspnoea depends on direct pressure, as by doing so we diminish the risk of injuring the aneurismal sac on introducing the tube. Both in the adult and child it is advisable to fix the trachea with a sharp hook before opening it.

The position of the patient, and general steps of the operation, are the same as in tracheotomy in the child. The incision through the skin should be commenced a little over the middle of the thyroid cartilage, and continued downwards in the mesial line for two or two and a half inches, through the skin, fat, and fascia, so as to expose the intermuscular texture connecting the sterno-hyoid muscles. The superficial veins are seen and guarded. Next the intermuscular texture is freely divided, and the sterno-hyoid and thyroid muscles separated with the handle of the scalpel. Then the large inferior thyroid veins and the isthmus of the thyroid body are pushed out of the way with the point of the finger, and the trachea opened, above or below the isthmus as the nature of the case may determine. In operating on persons in whom the rings of the trachea are ossified, the surgeon should provide himself with a pair of very strong scissors or small bone-pliers, to divide the ossified rings. The trachea-tube should always have a broad shield or metal band to maintain it in position. There has been of late a question raised as to the respective merits of the high and low operation of tracheotomy—*i.e.* above or below the isthmus. The truth is, each has its advantages in a particular class of cases. In croup and diphtheritic croup, whether in children or adults I consider the lower operation much preferable as being further removed from the diseased action. In chronic affections, such as ulceration, papilomata, etc., the higher operation, or even laryngo-tracheotomy, is indicated as being nearer the disease, and enabling us to treat by direct topical applications after a week or two.

The after-treatment is somewhat similar to that for the operation for croup already described. Any venous hæmorrhage generally ceases when the difficult breathing is relieved. If, however, it should continue, a little bit of lint pressed under the shield of the tube will suffice to arrest it.

The bold operation for extirpation of the larynx has been done by several surgeons of late years, especially by Billroth, Von Langenbeck, and the late Dr. Foulis of Glasgow. The latter in operating pursued the following method as described in the *Lancet* of Oct. 13, 1877:—

A vertical incision should be made from the hyoid bone to the second ring of the trachea, and the front and sides of the larynx should be freed from their superjacent structures, using the handle of the knife in so doing as much as possible.

"Arterial bleeding may be arrested as the operator proceeds, in order that there be no confusing of the parts. The trachea must now be drawn forwards with a hook and cut across; but great care is necessary at this point not to injure the œsophagus. A syphon tube of vulcanite is now to be inserted into the windpipe. In order that this fit accurately, it is prudent to have several different sizes ready. The upper and posterior attachments of the larynx must next be cut through, and in dissecting out the cricoid, the risk of injuring the gullet must be avoided by keeping the knife close to the cartilage.

"If there be much hæmorrhagic oozing from the raw surface it may be gently swabbed with a styptic solution; but it is better to avoid these local applications if possible, as they are apt to excite reflex irritation and vomiting. When the surfaces have healed, and the gap in the throat has contracted to some extent, Gusseubauer's artificial vocal apparatus, or Dr. Foulis' modification of it, may be used."

LECTURE XC VII.

INJURIES OF THE PHARYNX arising from the Lodgment and Impaction of Foreign Bodies : Modes of detecting and extracting them by Manual and Instrumental means—After-treatment when they have entered the Stomach—Diseases of the Pharynx—Late al and Posterior Pharyngeal Abscess—Structure of the Oesophagus: Spasmodic and Organic; Simple and Malignant.

THE INJURIES AND DISEASES OF THE PHARYNX form a department of practical surgery which is well worthy of your earnest attention. I will therefore treat the subject in the manner which I think most likely to commend it to your understandings, and impress it on your memories—namely, by drawing upon my personal experience for the illustration of the principles of treatment I advise.

INJURIES OF THE PHARYNX are generally caused by the entrance and impaction of foreign bodies which have been arrested in the act of being swallowed. These consist of pieces of food, fish bones, pins, coins, false teeth, and like substances. Such accidents necessarily require immediate attention and great care, both in immediate treatment and after-treatment.

When small bodies, such as pins or fish-bones, get entangled in the pharynx, they generally lodge behind the tonsil or beside the hyoid bone, where they are, as a rule, within reach of the finger. In searching for them, we should pass our finger backwards along one side of the mouth, upwards and downwards between the pillars of the fauces around the region of the hyoid bone, in front of the epiglottis and base of the tongue; then withdraw the finger, and, in doing so, make similar search on the opposite side. A sharp body is most frequently impacted between the pillars of the fauces, where it can be easily recognised and dislodged by the point or nail of the finger: but it may be in a position lower down, and still within reach of the finger, although it cannot be extracted by it. In such cases the finger can be used for detecting the position of the foreign body, and afterwards for guiding the point of the forceps to its site. These forceps must be used in this situation with very great caution and gentleness, for there is much danger in searching for foreign bodies with anything like carelessness and even with the utmost care there is considerable risk in fishing for such bodies with any instrument yet invented, for the condition of things may be aggravated instead of improved by their use. Thus, sharp point may be driven further home, and a slight abrasion of the mucous membrane increased to a laceration. If the impacted substance be obtuse and beyond the reach of recognition by the finger, or removed

by the forceps, the ordinary whalebone and sponge probang may be used with safety, to help it onwards towards its destination in the stomach or ejection through the mouth.

In some cases, where small sharp-pointed bodies are lodged far down, we may succeed in extracting them with the tubular expanding probang. This instrument consists of a fine whalebone probang, tipped with sponge, ensheathed in a gum elastic tube, except for about two inches above the sponge. From the point where the sheath terminates, a series of strong bristles are arranged longitudinally around the whalebone, and attached above to the gum elastic sheath and below to the sponge. The instrument, when closed, presents much the appearance of the common sponge probang; but when the whalebone stalk is pushed, and then drawn a little back, the bristles are projected, and expand like a parasol, so that, on withdrawing the instrument thus opened, it sweeps the circumference of the Œsophagus, and may catch and extract small foreign bodies sticking in the wall of the passage; but it is more ingenious than practically useful, and in most cases the common sponge probang answers best.

It is often very difficult to detect the presence of a small body in the pharynx, and still more difficult to remove it. The difficulty and danger are increased if the impacted substance be sharp in its outlines, or have pointed or hooked extremities. Both these conditions are sometimes met with when a false tooth is swallowed. I had to deal with a case of this kind some years ago, in the case of a lady who was subject to epileptic fits, and in one of these she swallowed a false tooth, the gold setting of which was much worn. Her ordinary medical attendant was sent for, but the tooth had passed beyond his reach. Later in the day he sent for me; and, after a patient search, I discovered the presence of the foreign body by means of an ivory-headed probang. It was situated much beyond reach of the extracting forceps; but, by means of the expanding probang, I succeeded in snaring it. The hook of the gold plate, however, had become fastened in the tissues, and for some time I could neither pull it upwards nor push it downwards. At length, however, I succeeded in unfastening it, and in pushing it down.

Several years ago a young man, a dentist's assistant, presented himself at the Royal Infirmary here, and stated that he had swallowed a false tooth. He was seen and examined by the late Mr. Syme, who passed a probang, but could detect nothing by it. He therefore concluded that the tooth had passed down to the stomach, and he dismissed the patient. Some days afterwards the young man returned, and complained of pain somewhat keener than before. Again he was carefully examined, and nothing being detected, he was again dismissed. About six weeks after this the late Dr. James Duncan was sent for hurriedly to see the patient in his lodgings; and, just as he entered the room, the young man vomited a large quantity of blood and died. On a *post-mortem* examination it was found that the small hook for attaching the tooth had become inserted into the front of the Œsophagus, through which it had ulcerated its way into the aorta: hence the fatal hæmorrhage.

A case which occurred in Edinburgh, under the care of the late Dr. Gillespie, so long ago as 1819, in which a double fish-hook was caught in the œsophagus, presents so much interest both as to the nature of such accidents and also as to the ingenious procedure for its extraction, that I have reproduced it amongst the Clinical Cases, from the hospital notes of the case kindly furnished me by Dr. James Gillespie.

In the case of a child who swallowed a button, I found it embedded very low down in the œsophagus, and, as I could not extract it, I pushed it downwards into the stomach. It was afterwards passed by the bowel along with the fæces.

In another case I felt a coin: the small œsophagus tube with which I was examining the passage luckily twisted when I drew it up, and brought up the coin along with it.

In many cases foreign bodies, such as coins, lodge at the top of the œsophagus, and are readily extracted by the pharyngeal forceps. Of these, two pairs, the blades of which open in different directions, are generally required, so as to adapt them to seize the foreign body, according to the position in which it may be. These forceps should always be used with great care, so that the foreign body may not be pushed

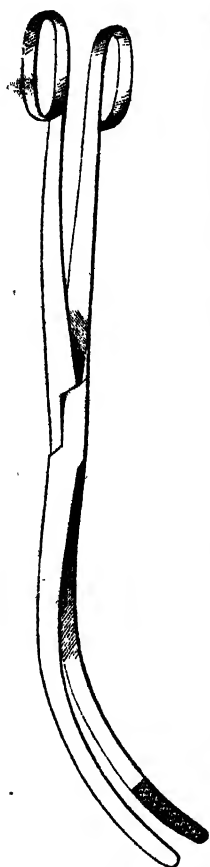
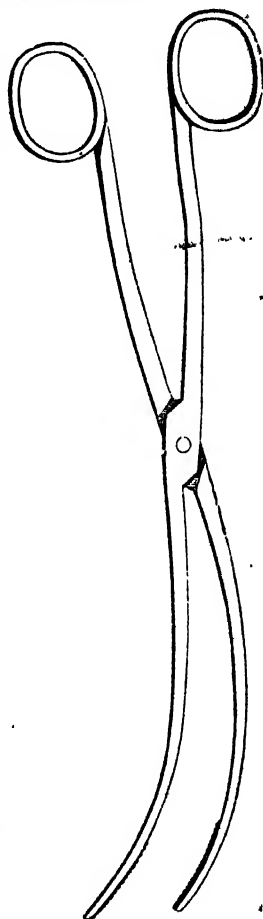


Fig. 190.



downwards, if its extraction be at all possible. When a smooth rounded body, such as a coin, has entered into the stomach, we of course desire to get it evacuated by the bowels as speedily as possible. Our object is to accelerate as much as possible the passage of the foreign body through the intestine, so as not to afford time for permanent lodgment. This can be best accomplished by giving, in addition to bulky farinaceous food, gentle laxatives, such as small doses of castor-oil; after two or three of which the foreign body is generally passed along the small intestine very readily. There is a risk that it may lodge in the large intestine about the cæcum or sigmoid flexure, and

therefore large distending enemata are very useful. The stools should be carefully examined, so as to make sure of the foreign body passing away.

When sharp-edged or pointed bodies, as false teeth, with sharp or hooked metallic fixings, enter into the stomach, the treatment requires to be somewhat different. Purgatives would be dangerous. It is necessary to blunt or cover over the sharp edges, so that they may pass through the bowels safely. For that purpose I generally order the patient to eat freely of raw prunes or figs, without chewing them much, that a coating may envelop the sharp points or edges of the foreign body, so as to enable it to pass safely through the intestine.

Bones, or portions of bone, often require to be forcibly pushed into the stomach, where, from their digestibility, they are not dangerous. Even the horn handle of a penknife has been found in the stomach nearly dissolved.

Should portions of soft food stick in the gullet, they ought at once to be pushed into the stomach. In using the probang, or stomach-tube, the finger should be passed down on the left side of the mouth, the tongue being neither pulled forwards nor pushed backwards, so that the parts be left as nearly as possible in their natural position. The head should then be thrown back, and the probang or tube passed almost vertically downwards over the finger. When the foreign body is touched, it may be fairly pushed into the stomach.

Poisonous substances which may have entered into the stomach, if soluble and non-corrosive, should immediately be withdrawn by the stomach pump. The use of the instrument should, however, be always avoided in cases of corrosive poisoning, because, while there is little or no chance of doing good, the tube may pass through the softened gastric walls into the abdominal cavity. In some cases of poisoning by acid, we ought to pass the tube into the œsophagus, and thereby inject pure alkaline into the stomach. Eucaly or alkaline carbonates are generally objectionable, from the effervescence and distension produced by the liberation of carbonic-acid gas.

The stomach-tube sometimes terminates in an open mouth, with the view that the grosser portions of the contents of the stomach may pass into it easily. This, however, is an objectionable form of the instrument, for the mucous membrane of the stomach is liable to be sucked in, and often seriously injured, while the tube is closed against the ingesta. The extremity of the tube should be closed, and the eye of the instrument ought in all cases to be very large, and beyond and above the point of the tube. To save time and trouble in emergencies, the instrument should never be fitted with screws, but with slip-joints. When poisoning is suspected, tepid water should be pumped into the stomach to hold the poison in solution. The fluid should then be pumped out, and the process repeated until the water is quite clear when withdrawn, and there is good reason to believe that the poison has been wholly, or as far as possible removed.

The surgeon may require to perform ŒSOPHAGOTOMY, when a foreign body is so fixed in the œsophagus that it can neither be drawn up nor pushed downwards. The obstruction is generally in the upper

part of the œsophagus. The incision for œsophagotomy should be made a little nearer the middle line, but very much in the direction of that for ligature of the left common carotid artery. The skin and fascia being divided, the sterno-mastoid is drawn aside, and any vessels which may bleed are tied. The finger, or the handle of the knife being used to separate the parts, the edges of the sterno-hyoid and thyroïd muscles are drawn to the mesial line. The thyroïd body is drawn inwards and upwards. The recurrent laryngeal nerve lies between the œsophagus and trachea on the left side, so that (and more especially when the œsophagus is distended by a foreign body) it is necessary to draw aside or avoid the nerve, and open into the œsophagus, where there are no nervous filaments upon it. The inferior thyroïd artery, which passes up to the lower angle of the thyroïd body, should also be carefully avoided, as well as its branches. The sheath of the carotid artery, of course, should never be opened, but merely drawn aside. When the foreign body distends the œsophagus, it is more easily cut down upon; but, as a precaution, a probang or metallic sound, should always be held in contact with it. From want of attention to this simple precaution I have seen a surgeon cut upon the cricoid cartilage, and open the air-passages, which caused a very disagreeable complication. The omo-hyoid muscle, if in the way, should be divided. The œsophageal swelling, caused by the foreign body or probang, is readily recognised, but the operator should dissect carefully, lest the recurrent laryngeal nerve or the inferior thyroïd artery should be between him and the œsophagus. The longitudinal fibres of the œsophagus being recognised, its walls are divided longitudinally and the finger introduced to feel for and guide the extracting instrument. The opening need not be large, as the muscular fibres dilate readily. A tube is then passed by the nostril into the stomach, and retained, to enable the patient to be fed, until the wound in the œsophagus has healed.

The diseases of the Pharynx and Œsophagus, to which I would direct your attention as coming within the domain of Surgery, are Pharyngeal Abscess and the different forms of Stricture of the Œsophagus.

PHARYNGEAL ABSCESES are either *lateral* or *posterior*. Lateral pharyngeal abscesses are those circumscribed abscesses which occupy one side of the pharynx only, immediately behind the tonsil. They are very difficult to diagnose, and may be mistaken for aneurism of the internal carotid artery, and *vice versa*. They project inwards towards the mucous surface, and there is often a feeling of pulsation from the close proximity of the abscess to the large vessels of the neck. The history of the case may guide us. Such abscesses generally occur in rheumatic patients, and there are pains in the neck and about the back of the ear, which are premonitory of a pharyngeal abscess forming; and so far these symptoms are diagnostic, but still they are not sufficient. In some cases I have been able to make sure of the disease by passing two fingers into the mouth, so as to let them rest upon the surface of the swelling, and in this way we can sometimes feel whether it is the

pulsation of an aneurism or merely the communicated pulsation from the carotid vessels: still the diagnosis is very difficult. In opening a lateral pharyngeal abscess there is danger of opening into the blood-vessels. We must be careful to turn the edge of the knife inwards here, and we should open the abscess as near the middle line as possible.

• The POSTERIOR or RETRO-PHARYNGEAL ABSCESS is usually diffuse, and occupies the whole of the back part of the pharynx, and bulges forwards. It is very often connected with disease of the bodies of the vertebræ. Even when this exists, where the abscess is threatening to cause suffocation by pressing forwards, we must interfere and open it, and in doing so we must be very careful. It is not difficult to open it with a bistoury wrapped round with lint, but if we open the abscess by a large incision, especially when it is overhanging the larynx, suffocation may occur, and I have known this happen. The pus gushes out, runs down the larynx, and so chokes the patient. To obviate this I would use a flat trocar, with a very sharp point, and perforate the abscess with this, so as to allow the fluid to come through the canula into the mouth. We may empty the abscess so far in this way, and then enlarge the incision with a probe-pointed bistoury, when the more fluid part of the pus has been got rid of. It is the sudden gush of matter at first that is apt to cause suffocation when the knife is used instead of the trocar.

STRICTURE OF THE ŒSOPHAGUS (fig. 191) is not uncommon, and, as in the case of other musculo-mucous canals, may be either simple or malignant. Spasmodic stricture occurs more frequently in the œsophagus than in any other mucous canal. This is easily explained when we consider the powerful muscular structure of its walls. Hysterical women are most subject to spasmodic stricture. The surgeon must also keep in mind that aneurism of the thoracic aorta or of the innominate artery may obstruct the passage by lateral pressure, and he should examine carefully before passing instruments to explore the œsophagus.

In stricture of the œsophagus there is difficulty in swallowing, and regurgitation of more or less of the food. Fluids are most readily swallowed, but should the stricture be very tight, even these are rejected. There is uneasiness at some part of the œsophagus, and sometimes a pain is felt passing back from the sternum to the spine between the shoulders. The patient often complains of great irritation in the throat, and spits up tenacious mucus as if to clear the passage. If the stricture be low down, a pouch sometimes forms, and the food, after remaining for some hours, may be ejected in a semi-digested state. But I have seldom seen the simple stricture so low down as the cardiac extremity of the stomach.

Stricture of the œsophagus may be the result of a chronic affection of the mucous membrane, causing gradual constriction, or it may be due to the swallowing of an irritant or corrosive substance, which, after exciting inflammation, is followed by a persistent narrowing of the canal. In either case there is consolidation of the sub-mucous texture, and afterwards of the muscular tissue—the canal being ultimately con-

stricted by an effusion of lymph and cicatricial contraction. The complete circular constriction is rarely seen. The stricture is more generally due to a puckering at one point in the circumference of the canal.

The diagnosis between the different forms of œsophageal contraction is most important. Sometimes spasmodic simulates organic stricture. The former is generally distinguished by its remissions and exacerbations, and by its frequent occurrence in females about the menstrual periods, and the almost constant presence of the symptom of the globus hystericus. In spasmodic stricture, the passage of a bougie, exciting muscular action, is apt to mislead, and therefore we use means to prevent spasm. If the patient be put under chloroform, and the large tube pass easily, the case is one of spasmodic contraction; but if the constriction still remain, it is organic, either simple or malignant. A patient labouring under organic stricture has generally a pinched and emaciated appearance, like a person who is suffering from slow starvation. The symptoms of malignant stricture occur more suddenly and progress more rapidly than in the simple form. It is not so much a stricture, properly speaking, as a cancerous tumour filling up and leading to obstruction of the œsophagus. It is usually placed either opposite the manubrium of the sternum or close to the cardiac end of the stomach, and is more common in the latter position.

Should the history and appearance of the patient point to malignant disease, instrumental interference is useless and hurtful. The occasional passage of bougies or the tube, may be required to introduce food, but their continued regular passage, as in simple stricture, for the purpose of dilatation, not only excites the disease to greater activity, but often causes serious hæmorrhage. The treatment is wholly palliative. In one patient attending the hospital lately, with malignant disease at the cardiac extremity of the stomach, the passage of an instrument relieved rather than excited the disease. To perform gastrotomy in such cases is, I think, absurd, and would bring little credit to surgery.



Fig. 191.

Simple organic stricture is treated by the passage of bougies, and, if necessary, a tube to introduce food into the stomach. The bougie should be of gum-elastic, and should be allowed to remain in for a few minutes. The size should be gradually increased every four days, unless this excites too much irritation.

The irritation at first caused by the instrument ceases as the stricture dilates. The process of dilatation must be a gradual one, and therefore bougies should not be passed too frequently. After the dilatation has been fully accomplished it is advisable to pass a bougie occasionally to prevent risk of recurrence of the contraction.

CLINICAL CASES.

FACIAL AND CERVICAL REGIONS.

CASE OF EXCISION OF THE LOWER JAW, IN WHICH BOTH LATERAL PORTIONS OF THE BONE HAVE BEEN REMOVED, LEAVING MERELY A SMALL PORTION AT THE SYMPHYSIS.—*Ed. Med. and Surg. Journal*, 1843.

My principal reason for publishing the following case is, that it is the only one, as far as I am aware, in which both lateral portions of the inferior maxilla have been removed, leaving merely the symphysis of the bone remaining, and hence I considered it might be interesting to the profession.

The first operation on the patient whose case is the subject of the communication, was performed by Mr. Fergusson (now Sir William Fergusson) in 1836 ; and, through the kindness of that gentleman, I am enabled to commence the history of the case with his report.

“Mrs. Fitzpatrick, aged 46, received a blow on the right side of the lower jaw several years ago, and since then various small portions of bone have been discharged from time to time. A tumour has gradually formed on the bone between the angle and the chin, and has since attained the size of a hen’s egg, its growth having increased rapidly within the last five months. There is no particular pain in the part, but it now begins to annoy her from its size. On the left side the alveolar processes are somewhat thickened, and the teeth on both sides are very deficient, only a few stumps remaining.

“With the concurrence of Sir George Ballingall, Mr. Nasmyth, and others, I removed the tumour on the right side on the 12th of March 1836, having divided the bone behind and a little above the angle, and in front a little anterior to the mental foramen. The wound healed kindly, and a firm cicatrix formed in the mouth between the divided ends of the maxilla. I used occasionally to see this patient afterwards, and observed that the swelling on the other side was gradually increasing. Several sections were made of the part which had been removed, and each surface presented a smooth dense aspect of a homogeneous character throughout. The deposit of new structure had seemingly taken place between the alveoli and the maxillary canal, as the latter part had been pushed downwards until it had reached the external plate of bone on the lower margin of the jaw. There was no soft point in the growth, and nothing to indicate malignancy.” Such is Mr. Fergusson’s history of the patient whilst under his care.

I first examined this patient in August 1842, at the request of Mr. Lawson, to whom she had applied for advice. She at that time complained of great pain in the remaining portion of the jaw, a little in front of the angle of the bone, and on examination a hard tumour, about the size of a large walnut, flattened, could be felt situated in front of the angle of the jaw.

Her own history of the disease was similar to that given by Mr. Fergusson, except that she stated that a piece of bone had been discharged from the left as well as from the right side of the jaw, and that the tumour for which she now consulted me had existed for about five years before the former operation was performed. As she stated that the tumour was enlarging, that the pain had of late become more violent, and as her health was sinking from the want of rest and continued suffering; and as, judging from the firm feel and previous history of the tumour, it did not seem malignant, I recommended her to have it removed. To this, however, she could not then make up her mind to submit. In the end of September I was again requested to see her, when the pain had become so violent that she said she would submit to anything that would relieve her. I showed the case to Sir George Ballingall, Professor Syme, and Mr. Nasmyth, and these gentlemen coincided with me in recommending an operation.

I performed the operation on the 20th of October 1842, in presence of Sir George Ballingall and several medical friends, and assisted by Drs. Handyside, Duncan, and Mr. Nasmyth. Entering the bistoury in front of the insertion of the masseter muscle, I transixed the membrane of the mouth, carried the knife forward along the bone and cut outwards, dividing the prolabium and other soft parts a little to the left of the symphysis, and thus at once formed a flap which laid bare the tumour, and enabled me to apply the saw to it. Having ascertained its nature, and finding that its entire removal was necessary, I made an incision downwards from over the articulation of the jaw, terminating in the external end of the former incision. The semilunar flap so formed was then dissected up, the bone cleared from the soft parts on its inner surface, and sawn in front of the canine tooth. I then depressed the bone so as to enable me to divide the insertion of the temporal muscle, and completed the operation by disarticulating the lateral portion of the jaw; five arteries were tied, some slips of lint placed in the deep part of the wound, and the edges of the incision were then brought together by some points of interrupted suture, except at one point midway between the ear and chin, which was left open for the ends of the ligatures to hang out.

Everything proceeded favourably: the external incision healed by the first intention, except where the ligatures hung out. The slips of lint were removed from the deep incision on the third, and the patient was sitting up on the ninth day. The last ligature came away on the twelfth day. This ligature had been brought out at the upper part of the incision in front of the ear, and on its separation saliva continued to flow from the opening for some days, but it soon healed under the use of pressure, by means of a compress of lint applied over the fistulous opening.

Remarks.—It may seem at first sight of little use to leave the mere symphysis remaining, as, when deprived of the support of the lateral portions, it was as likely to be retracted along with the tongue as to prevent that occurrence. The reasons which induced me to leave that portion of the bone were—1st, That it would afford a better hold for the gentleman who assisted me, to prevent retraction during the operation; 2d, That when the wound healed it would afford support to

the lower lip, and thus in some measure prevent the constant escape of saliva; and that, as it would contract adhesions to the cicatrix, by preserving the attachments of the muscles of the tongue, the patient would be enabled to speak and swallow better than if it had been removed; and, *lastly*, By preserving somewhat the appearance of the chin, the operation would be followed by less deformity, and the patient rendered more comfortable; whereas, if the symphysis had been removed, the retraction of the lower part of the face would have been greater, the tongue would have formed adhesions to the fore-part of the lip, and thus, from its pendulous position, have given rise to a constant and profuse discharge of saliva, as was the case in the patient mentioned by Sir George Ballingall, and speech would necessarily have been very indistinct.

The result of the case has fully justified these conclusions: there has been no violent retraction of the tongue; the patient is able to speak as well as before the operation; she swallows easily, can shut and open the mouth, and protrude and retract the tongue readily. The escape of saliva when sitting up is very trifling, and is gradually becoming less.

A section of the jaw, made by my friend Mr. Goodsir, shows the tumour to be of a dense solid structure, except in its centre, where soft degeneration was apparently just commencing.

The woman lived for fourteen years after the operation, and had a certain amount of power of chewing with the front teeth, so that she could eat animal food. On examination after her death, I found that the space on each side of the symphysis, from which the jaw had been removed, was occupied by a very dense structure, into which massetic and internal pterygoid muscles were attached.

MALIGNANT TUMOUR OF RIGHT SUPERIOR MAXILLA.

Susan W., *æt.* 41, unmarried. Admitted to Ward XIX. *March 8th*, 1865.

Patient caught cold last Christmas, and first noticed a swelling of the cheek a few days later. She rubbed the cheek with some liniment, but the tumour continued steadily to increase. Accordingly, three weeks ago, she consulted a medical man in Glasgow, who incised the swelling, and removed a portion of it. It then disappeared, but quickly attained its former size.

She had been perfectly healthy, but since the appearance of the tumour she has lost both strength and appetite.

On examination, a tumour of the size of an orange, of firm consistence, is found to occupy the right superior maxilla. It involves the whole of that bone, and extends across the hard palate. The right nostril is almost completely occluded.

The superficial veins are dilated over the tumour; the skin and soft tissues of the cheek everywhere firmly adherent to the tumour. Patient suffers great pain. The neighbouring glands are not affected. The lungs and heart are found to be healthy.

March 12th.—Had smart hæmorrhage from the right nostril this morning.

13th.—Considerable diarrhœa during the night. P. 100, weak. No recurrence of hæmorrhage.

14th.—Slept well after an opiate. P. 100, weak.

15th.—To-day Professor Spence removed the tumour. He made a horizontal incision from the angle of the mouth. Then he made an incision from the inner canthus, joining the first. A third incision was made from the inner angle of the eye to the corner of the mouth, so as to remove all the soft parts implicated in the disease. The flap was dissected off, and the bone sawn through at the outer and inner angles of the orbit. The soft tissues of the mouth were divided on the hard palate, beyond the seat of disease. The alveolar process was then sawn through, and the other connections of the bone divided with cutting-pliers. Part of the septum nasi and the palatal process of the left upper maxilla were removed. A few vessels in the cheek required ligature. From the gap left by the removal of the tumour and textures of the cheek, an incision was carried from the angle of the mouth downwards and outwards for about three inches below the lower jaw, and curved backwards in the neck, so as to shape a somewhat triangular flap, which was dissected, and brought up to form a new cheek. The soft tissues were brought together with sutures, except a small portion below the lower jaw, which part was left to granulate. P. 140 after the operation. A full opiate was given, and an enema of beef-tea and brandy. To have wine and water at intervals.

Vesp.—P. 96, strong. Has slept well. No pain and no oozing.

16th.—P. 100, good strength. Slept well without an opiate. Slight redness about the edges of the wound. To have no stimulants. To have beef-tea, arrowroot, etc.

Vesp.—P. 120, fair strength. Ordered a compound colocynth pill.

17th.—Still some redness about the wound. Some points of suture removed. P. 120.

19th.—P. 90. Flaps yielding at corners of mouth and eye.

20th.—Had a severe rigor at 12.30. Given brandy and morphia, and hot bottles applied.

22d.—Ligatures came away. P. 95.

24th.—Wound kept together by plasters.

April 5th.—P. 75, strong. Going on most favourably.

8th.—Sat up to-day.

23d.—Wound all but healed. Walks about the ward.

30th.—Sent to Convalescent House.

CASE OF ENORMOUS DEEP-SEATED TUMOUR OF THE FACE AND NECK, SUCCESSFULLY REMOVED BY OPERATION.

In the beginning of October 1862, I received a letter from Dr. Phipps, of Manchester, in reference to the patient whose case I am about to narrate. He gave me the general history of her case; and enclosed three photographic portraits, exhibiting a tumour from different points of view; and requested me to say whether I thought there was any possibility of removing it, as she was willing to run any risk to have it removed. The history of her case was as follows:—

Mrs. Jepson, aged thirty-four, of a healthy appearance, states that, when eighteen years old she noticed what she calls a "waxen kernel," growing under the skin over the mastoid process of the right side, and immediately under the lobule of the ear. For two years it showed no tendency to grow larger, but afterwards it increased slowly; and she applied for relief to several medical men. In spite of the use of iodine, externally and internally,

it continued to grow. She was married when she was twenty-one years of age, and states that during her pregnancies the tumour appeared to increase more rapidly than at other times. Four years after her marriage the growth had reached the size of a hen's egg; and she was taken by her medical attendant to the Manchester Infirmary, to obtain the advice of the surgeons of that institution. They told her that the tumour might be removed; but that she must take the whole risk of the operation on herself. Her own medical attendant seems to have dissuaded her from having anything done. Since then the tumour has continued gradually enlarging; but of late it has shown a marked tendency to more rapid increase.

I was informed that the patient, harassed by the weight and deformity of the tumour, had recently applied to a surgeon at Manchester to have it removed; but he declined interfering, and dissuaded her from submitting to any operation. I wrote, in reply to Dr. Phipps, that though I could not decide without personally examining the patient, I was inclined, from the history he gave of the growth, and his account of its general relations, to think it might be removed, and that I would arrange for her reception under my care if she came to Edinburgh, as contemplated. She was admitted into my wards in the Royal Infirmary on the 11th November 1862.

Appearance on Admission.—The patient is a somewhat pale, but not cachectic-looking woman. There is an enormous tumour, as large as her head, projecting from the right side of her neck. Its boundaries are the following:—Beginning about one inch from the second cervical vertebra, it passes downwards to within an inch and a half of the clavicle; then sweeps obliquely to the middle line of the neck, which it reaches near the cricoid cartilage. It then passes upwards by the side of the chin, close by the angle of the mouth—which is not distorted; and round by the outer angle of the orbit, and through the lower part of the temporal region, and thence to the spinal column, on a level with the meatus auditorius externus and apex of the mastoid process. The lobule of the ear is very considerably stretched. The surface of the tumour is irregular, presenting a lobulated appearance; the most prominent part is that which projects forwards from the face, and where there is a feeling of fluctuation; the rest of it is solid. The veins over the surface are not markedly distended. The anterior portion of the tumour is more movable than the posterior. There is no glandular enlargement, either in the subclavian space or on the left side of the neck. Respiration and deglutition are not in the least interfered with.

November 18th.—Since the 16th instant she has been very sick, with occasional vomiting; but to-day she feels much better. The sickness is almost entirely gone, but the fauces are inflamed. Pulse 92.

November 21st.—The throat is still inflamed; otherwise she feels better.

Operation.—On the 2d December, Mrs. Jepson having quite recovered from the febrile attack from which she suffered after her admission into the hospital, I proceeded to remove the tumour. The patient having been placed recumbent, and brought under the influence of chloroform—her head and shoulders supported with pillows, and her face turned towards the left side, I commenced the operation by making two slightly curved incisions, extending from the lobe of the ear to the sternal attachment of the sterno-mastoid muscle, so as to mark out an elliptical portion of skin, about three and a half inches broad at its widest part, over the middle and prominent part of the tumour—the anterior incision corresponding nearly to the internal edge of the mastoid muscle. I next made an incision backwards and slightly downwards from the middle of the posterior longitudinal incision, so as to extend beyond the posterior limit of the tumour; and lastly, an incision from a

point external to the angle of the mouth, was carried obliquely downwards and outwards, so as to fall upon the centre of the anterior longitudinal incision. The four large flaps of skin and platysma myoides thus marked out were then dissected and reflected off the tumour, commencing with the posterior—the external jugular vein being tied with two ligatures, and divided between them. When the whole surface of the enormous growth was thus exposed—except where the elliptical portion of skin remained—the sterno-mastoid was seen to be so attached to the tumour about its middle, that I divided it above and below that part. I then relieved the anterior margins of the cervical portion by a careful dissection, keeping the edge of the knife towards the tumour until I was fairly beyond the line of the great vessels. My dissection was continued from the lower and posterior part till the phrenic nerve was seen clearly, and the upper and posterior portion, which had been previously so far relieved, was then rapidly detached from its deep connections, and the whole of the cervical mass of the tumour was free. The detachment of the facial and parotid portion still remained to be accomplished; and this required great care, both because that part of the tumour seemed more cystic, and also because, as I expected, it was deeply connected behind the ramus of the jaw. On dissecting it from before, downwards and backwards, I found it attached to the fascial covering of the posterior belly of the digastric muscle, so that I had to dissect the muscular fibres. Above it dipped deeply between the mastoid process and the jaw; but, partly with the finger and careful dissection with the knife, it was detached pretty easily, till I arrived at the attachment under the ear over the mastoid process. Here it was firmly adherent, and the weight of the tumour caused a slight tear of its substance; but by having the tumour supported, I dissected this attachment carefully, so as to remove the whole tumour entire. A large vessel entered it at this point, which was readily secured. During the operation some arteries which bled were tied as cut; and also some large veins, previous to their division. The chief bleeding during the operation was venous, from the divided veins passing from the tumour; but the whole quantity of blood lost certainly did not amount to eight ounces. The wound resulting from this dissection when the tumour was removed, extended from the zygoma to the clavicle and sterno-clavicular articulation. In the facial portion the parotid gland seemed either atrophied, or so displaced, that nothing was to be seen of it in the deep space between the jaw and the mastoid process. The portio dura—the cervico-facial portion of which had been unavoidably cut—was seen crossing to the face; and the external carotid could be felt pulsating; and the digastric was seen dissected here. In the cervical portion of the wound the great internal jugular, and its tributary veins, and the carotid artery, were exposed for nearly their whole length, and posteriorly, the phrenic nerve was seen lying on the anterior scalenus. The flaps were brought together by a few points of suture, and seemed to be rather redundant, notwithstanding the elliptical portion of skin removed. A flat fold of lint was placed lightly over the wound.

During the operation the chloroform caused vomiting. The patient was carried to bed; hot-water bottles were applied to the feet, and a brandy enema given.

Dec. 4th.—Slept tolerably well during the night; sickness pretty severe; ordered brandy and ice; pulse 128.

Dec. 5th.—Pulse 130; slept pretty well; has taken a little food; the facial nerve seems slightly affected; she feels very little pain in the wound.

Dec. 6th.—Pulse 96; several stitches removed.

Dec. 8th.—Pulse 98; slept better than she has done since the operation;

the lower angle of one of the flaps showing a tendency to inversion, a piece of lint was introduced below it, and the wound dressed with a solution of chloride of soda.

Dec. 9th.—Wound discharging freely; continue dressing; affection of the facial nerve not so marked; pulse 96.

Dec. 10th.—Still improving; had a very refreshing sleep last night; taking her food well; pulse 92.

Dec. 15th.—Wound looking well; dressed with a solution of chloride of soda; taking food well; sleeping well, and not complaining of pain; has been sitting up a little occasionally since last report; pulse 84.

Dec. 17th.—Still improving in every respect; pulse 84.

Dec. 20th.—Wound still discharging freely; appetite good; pulse normal; ligatures came away to-day at dressing.

Dec. 23d.—Yesterday she became sick, and vomited several times after dinner; sickness continued occasionally during the night; this morning she is not nearly so sick as the day before; the wound presents the appearance of gray phagedena, with erysipelatous blush on the skin; touched it lightly with nitric acid; tongue whitish; pulse 112.

Dec. 24th.—Sickness entirely gone; the wound rather dusky-looking; the surface touched slightly with nitric acid.

Dec. 25th.—The wound has much the same appearance as it had yesterday; continue treatment; pulse 96.

Jan. 6th.—Since last report she has been improving very satisfactorily; this morning she walked from Ward XX., where she has been lying temporarily, to her old quarters in the private ward; the wound is looking well, and the tongue clean; and the pulse is 88.

Jan. 12th.—Is much improved; sat up for an hour yesterday; the wound is healing rapidly.

Feb. 3d.—Since last report the patient has gone on improving daily; the wound is now almost entirely healed; and she left the hospital to-day for the Convalescent House.

After remaining for some weeks in the Convalescent House till the cure was completed, Mrs. Jepson returned to her home at Over-Darwen, Lancashire; and since her return I have heard frequently, both from herself and also from Dr. Phipps, who states that her health is good and her appearance gradually improving; the marks of the cicatrix becoming less evident.

Examination of the Tumour after its removal.—The growth was of a very irregular form, but may be described as an irregular ovoid mass, $9\frac{1}{2}$ inches in length, $8\frac{1}{4}$ inches at broadest part; its thickness or projection $7\frac{1}{4}$ inches, and weighing rather more than 7 pounds. It was nodulated on its surface, some of the larger projections looking like cysts, and feeling soft to the touch. The whole growth, however, was composed of solid matter, and presented, on section, the characters of the fibro-cartilaginous form of fibrous tumours. A careful examination of its structure was made by my friend Dr. Haldane, who has favoured me with the following description of it:—

“On section, the mass was found to consist of two kinds of material; the most abundant, and that which formed the basis and the greater part of the tumour, was of a glistening appearance, a pale bluish-white colour, and was of firm, almost cartilaginous consistence. Mixed with this and occurring generally in bands, but sometimes in small patches, was a softer and more friable matter, of a pale opaque yellow colour. A few small masses of a glistening yellow appearance, evidently consisting of fat, were scattered through the mass.

“On microscopic examination the firm glistening portion of the tumour

was found to consist of a finely fibrillated structure, in which were embedded oval, rounded, or elongated nucleated cells, having all the characters of cartilage-cells: these varied in abundance in different parts, being in some places as numerous as the cells in true cartilage, in others but sparsely disseminated. The yellowish opaque matter consisted of granular material and small cells, apparently in process of disintegration; they resembled tubercle corpuscles or shrivelled pus-cells, but were somewhat larger; they contained no nucleus, but in many one or more granules were seen. The matter, which to the naked eye seemed fatty, was proved to be so on microscopic examination."

Remarks.—The case just detailed seemed to me worthy of notice on account of the great size of the tumour, its important anatomical relations, and the formidable character of the operation required for its removal; but especially as giving encouragement for surgical interference in similar cases of deep-seated cervical tumours, and as indicating certain principles, both in regard to the kind of growths suitable for operation, and the points to be attended to in effecting their removal.

Operations for the removal of large tumours from the neck are always attended with great danger from the proximity of the numerous important structures in that region, and the impossibility of thoroughly commanding the circulation through the great vessels during the operation. Large tumours, arising in the parotid and passing into the cervical region, have been frequently removed when placed superficially to the sterno-mastoid muscle. But some surgical authorities regard cases of tumours developed beneath that muscle as unsuitable for removal by operation; and, in point of fact, few if any cases of complete and successful removal of such tumours are recorded; at least, after some research, I can only find four cases mentioned:—One by Mr. John Bell in his work on *Surgery*, vol. iii.; two by Professor Warren of Boston, in his work on *Tumours*; and one incidentally mentioned by Mr. Liston in his *Practical Surgery*. Of the three first-mentioned only, are the details given, and in none of them was the whole tumour removed. Mr. Bell, who describes the operation in his usual graphic style, confesses that he left some small roots of the tumour attached to the transverse processes of the vertebra for fear of injuring the phrenic nerve. The tumour rapidly recurred, and destroyed the patient. In one of Mr. Warren's cases, only portions of the growth could be removed, as it involved all the textures intimately; and, after ligature of both the carotid artery and internal jugular vein, a large mass was left, being connected with and projecting into the pharynx. In his second case, Professor Warren, after clearing the surface of the tumour, rather than divide the sterno-mastoid for fear of injuring the spinal accessory, "the consequences of which last I was unacquainted with," adopted the alternative of cleaving the mass perpendicularly in its long axis, so as to remove the two halves from under the muscle; and here, again, he tied and divided both the carotid and internal jugular; but some parts of the tumour in front of the vertebrae were left, the actual cautery being applied to them. The details of the case subsequent to the operation are meagre; very grave symptoms appear to have followed immediately, but the patient seems

to have rallied, and though we are led to infer that he did recover, nothing is said of the ultimate result, or whether the tumour was reproduced or not. The only notice of Mr. Liston's case I can find is contained in *Practical Surgery*, chap. v., "On the Injuries and Diseases of Muscles and Tendons." He says:—"I had occasion to remove the sterno-mastoid muscle of one side, involved in a sarcomatous tumour, from its origin to its insertion—a growth to which the most fastidious critic will not refuse the term sarcoma; though, in all probability, the muscular fibres may have been involved secondarily. The tumour was so far limited by a cellular sheath, yet the dissection was difficult and extensive. The patient made a good recovery, and no malposition of the head followed."¹

So far as I could judge from this brief account of Mr. Liston's case, it seemed a growth developed in the substance of the mastoid, surrounded by the fascial sheath of the muscle; and if so, differing very much from the enormous and irregular tumour I had to deal with. The cases recorded by Bell and Warren, though not successful in complete removal of the tumours, possessed this element of encouragement, that, whilst the failure depended on the character of the growth being unsuitable for any operation, they showed how much could be effected even under unfavourable circumstances, and so led me to infer that if the character of the growth were suitable, the difficulty of the operation need not be an obstacle to its performance.

In determining the propriety of operative interference in Mrs. Jepson's case, it seemed to me that the points principally to be considered were: 1*st*. The character of the tumour; whether simple or malignant? 2*d*. The probable result, if the growth were left to itself? 3*d*. How far its enormous size, anatomical relations, and possible connections with vitally important parts, might endanger life, or prevent its complete removal?

Correct diagnosis as to the character of the growth is most important in deciding on the question of operation in all cases of tumour, as involving the probability of future immunity from the recurrence of the disease. But in the case of large tumours in the vicinity of important organs, it is also important as to the question of immediate danger to life in the operation. In my surgical Lectures I have always dwelt upon the limitation of simple, as compared with malignant tumours, as a principle of great practical value. In simple growths, important organs—such as great vessels and nerves—may be pressed upon, pushed aside, or even surrounded by the tumour or its lobules; but the cellular sheaths are not destroyed; and even if the growth has formed adhesions to the sheath, the vessels themselves are free; whereas in malignant growths we find no such limitation. On the contrary, the disease often invades all the textures, destroying the

¹ Since writing the above, I have found in one of the Journals of the Royal Infirmary for 1834, the report of a case of large cervical tumour, operated on by Mr. Liston. The tumour, which occupied nearly the same position as the cervical portion of my patient's tumour, had grown rapidly in about two years. In this case Mr. Liston found it impossible to remove the whole growth by the knife, and the part near the vertebrae was strangulated by ligatures passed through its base. The patient recovered at the time. —J. S.

cellular sheaths, and involving the vessels and nerves themselves; and even when the mass of such a tumour is enclosed in a dense cyst, and apparently movable, it is not truly limited; but the narrow prolongations of the diseased structure dip deeply amongst the textures and form such connections as to defy any certainty of complete removal, as happened in the cases recorded by J. Bell and Warren, already referred to.

In the case of Mrs. Jepson, the originally slow progress of the growth, the comparatively unimpaired state of her general health, together with the appearance of the tumour and the absence of that anxious expression of countenance which marks most cases of malignant cachexia, were all conditions indicative of the simple character of the growth; whilst the more rapid increase latterly noticed, though a reason for interference, was only what we find in most tumours, however benign, and depends on enlargement of their vessels, and consequent increase of nutritive supply. So far, then, as the character of the growth was concerned, there was everything in favour of operation, as the tumour was neither likely to involve the neighbouring textures nor liable to recur after removal.

The second consideration was, the probable progress of the tumour if left to itself. As yet, neither respiration, deglutition, nor any vital function, had been affected by the growth; but then it had of late begun to increase more rapidly in bulk, and over the most prominent part the skin had a dusky red appearance, which showed a tendency to ulceration; and when that once commences, even in simple tumours, we know how rapidly they fungate, slough, and bleed—degenerating locally, and exhausting the patient by discharge and pain—and that their removal then becomes much more difficult and dangerous. Besides, the nutrition or the growth was evidently carried on at the expense of the patient's general health; for though not cachectic, she had become pale, and felt more feeble than formerly; whilst the enormous bulk and weight, together with the increasing deformity, rendered her almost unfit for any duty, and gave rise to great mental depression, so that she was most anxious to have the tumour removed at all hazards. The consideration of these first two questions resulted in a decision favourable to operative interference. It now remained to consider how far the size and connections of the tumour admitted of removal by operation without immediate risk to the patient's life; and to plan the procedure by which this could be most readily and safely effected. The great bulk of a tumour, though always a source of risk, from the extensive incisions requisite for its removal, the amount of surface exposed, and the proportional hæmorrhage, venous and arterial, does not necessarily render the operation more difficult; on the contrary, the very size gives a power of leverage which often facilitates the dissection. But when the mass is so situated as to present a large surface, it may be adherent to, or in close connection with, vitally important parts, then the operation required for its removal becomes most formidable. These elements of difficulty and danger were present to their fullest extent in my patient's case; for, besides the enormous bulk of the tumour, it was developed beneath the sterno-mastoid, and its deep

surface was necessarily in the closest relation with the great vessels and important nerves in the cervical region, from the lower jaw to within an inch of the sternum, and stretching backwards to the margin of the trapezius muscle: whilst the facial portion felt fixed in the parotid region, as if deeply niched behind the ramus of the jaw; and it could be felt projecting towards the fauces within the mouth. The bulk, form, and position of the tumour rendered it impossible to ascertain positively whether or not it adhered at any point to the sheath of the vessels; and the apparent mobility of a large cervical growth can never altogether be depended on; for, even if it involve or be adherent to the vessels or their sheath, these, being closely connected, move with the tumour on the more fixed parts. But in the face of these risks I felt warranted to operate on the following grounds:—First, as I have already said, the simple character of the tumour made me feel secure that, though it might displace, press upon, or even adhere to the sheath of the great vessels and nerves, it would not absolutely involve them. Secondly, the absence of any engorgement of great veins of the neck on either side, or of any marked alteration in the arterial supply of the right side of the face, made me pretty sure that neither the internal jugular nor the carotid could be very closely or extensively involved; whilst the functions of respiration and deglutition being unimpaired, and no symptom of laryngeal irritation existing, rendered it equally clear that neither the vagus nerve, its branches, nor the phrenic, were as yet implicated.

Having thus satisfied myself that the tumour might be removed by an operation properly planned, and carefully and deliberately executed, I proceeded to determine the method by which it could be most readily and safely accomplished. The dangers to be apprehended were—Hæmorrhage from the arteries supplying the tumour, or, more likely, from the great veins returning the blood from it, the risk of air entering any of these large veins when divided; the risk of injury to the vagus or phrenic nerves; and the probability of meeting difficulty from adhesion of parts in the parotid region, where the tumour felt fixed; lastly, exhaustion of the patient from the necessarily tedious dissection and large exposed surface. To obviate these dangers as far as possible, I determined to expose freely the whole surface of the tumour; to clear its edges; and, in doing this, to expose the anterior margin of the sterno-mastoid muscle, at the lower part of the neck, so as to be able, if necessary, to compress the carotid; next, to divide the sterno-mastoid above and below, so as to leave the part adherent to the growth; to tie the external jugular with two ligatures, and divide it between them; and to pursue the same course in regard to all the larger veins passing towards the jugular or root of the neck, and to secure the larger arterial branches as divided. Ligature of the lower part of the common carotid, as a preliminary, with a view of diminishing loss of blood—which has been advised and adopted in the removal of tumours from the neck and face—I rejected as worse than useless, as not only incurring unnecessary risk to the patient, but as likely to lead to danger by inducing a false security in the operator, as its ligature could not control the retrograde hæmorrhage from the free anastomosis superiorly; whilst

the free incision along the sterno-mastoid enables the assistant to control the carotid trunk quite as effectually, should it be necessary. Besides, in such a dissection, wound of the great internal jugular vein is much more likely to occur than injury of the carotid; and the best means of avoiding either is to disturb the natural relations of the vessels as little as possible, and to dissect with the edge of the knife directed towards the deep surface of the tumour, whilst the assistant insinuates his fingers in the track of the dissection, so as to protect the vessels. I decided, after clearing the tumour from the great vessels, to dissect the rest of the cervical portion from below upwards, so as to avoid injury to the phrenic nerve: and then to proceed with the dissection of the facial portion from above downwards and backwards, so as to leave the part which felt most fixed in the deep parotid region, and where I expected the largest vessels to enter the tumour, to the last. This plan I carried out, as detailed in the description of the operation, with the able assistance of my colleagues, Drs. Gillespie and Watson; and I had the satisfaction of removing entirely this enormous tumour, and so relieving my patient from what she and her friends had long regarded as a hopeless disease.

In a letter I have received from Mrs. Jepson, dated October 8th, 1863, she says:—"I am happy to inform you that I am in good health; the scars do not look bad; they are perfectly healed up, and gradually appear less." When I last heard of her, she was quite well, had had two children, and remained free from any appearance of the tumour returning.

LARGE CERVICAL TUMOUR SUCCESSFULLY REMOVED.

The following is an example of the excision of a growth similar in character, though presenting some local peculiarities —

George Manson, æt. 16, recommended to me by Dr. Grant Smith of Thurso, on account of a large cervical tumour, was admitted into the Royal Infirmary under my care on the 9th of June 1867.

On examination, the tumour, which was somewhat irregular in form, nodulated on the surface, and of firm consistence, was found to occupy the whole of the left side of the neck. Commencing at a point close under the angle of the jaw, it passed beneath the sterno-mastoid muscle, and then projected towards the surface, extending back to and elevating the anterior margin, of the trapezius, and occupying the whole of the supra-scapular and subclavian regions of the neck, where it lay below the posterior belly of the omo-hyoid muscle. On the mesial side of the sterno-mastoid the tumour projected inwards, pressing the larynx and trachea to the right side; it bulged upwards to a level with the os hyoides, and below it dipped beneath the muscles in front of the trachea, and descended into the supra-sternal fossa. The growth seemed movable, and its margins were pretty well defined, except at the sternal region, where it appeared to pass deeply, and where the superimposed textures bound down its surface so as to prevent its connections from being so clearly ascertained as in other directions. It was not moved by the efforts of deglutition, but the position of the belly of the omo-hyoid was very distinctly seen over the

posterior portion of the tumour during such efforts. The superficial veins of the left side of the neck were somewhat larger and more numerous than those of the opposite side. The history of the case showed that the tumour had been originally, and for many years, of slow growth. It was first noticed when the boy was three years of age, and increased little for the first eight or nine years; but of late it had progressed more rapidly, especially during the last two years. There was no pain, nor interference with deglutition, but for some months the breathing at night had become oppressed and at times spasmodic. The lad's health was good: there was no appearance of emaciation, and all the functions were natural.

The tumour was firm, and apparently solid throughout, and, as I have said, tolerably well defined. The youth and his friends were anxious that something should be attempted to relieve the increasing difficulty of breathing; and on my stating that I thought the removal of the tumour advisable, they readily consented to the operation.

On the 12th of June I performed the operation for its removal in the following manner:—I first made an incision along the course of the sterno-mastoid, from the angle of the jaw to beyond the sterno-clavicular articulation. Then at its lower termination I made a small transverse incision, about an inch and a half in length, so as to enable me to expose more fully the part where the tumour passed into the sternal fossa. Lastly, I carried a third incision, four inches long, from the middle of the first incision backwards to the anterior margin of the trapezius. I then dissected the skin and platysma, so as to expose the anterior portion of the growth as far inwards as the tracheal margin, which I cleared from the fascial covering, and elevated. Next, passing my finger beneath the fascia and the fibres of the omohyoid muscle, which were stretched over the growth at the lower part of the neck, I divided them, and had the satisfaction to find that the substernal portion was defined and unattached, and could be readily turned out. I now proceeded to clear the remainder of the tumour by dividing the sterno-mastoid transversely, and dissecting it and the other coverings off from the surface in two flaps as marked out by the incisions. In doing this, some small superficial vessels were tied. On fully exposing the tumour, a large vein was seen on its surface at the upper part. This vein, though distended above, was obliterated where it lay over the lower part of the growth. The distended part of the vein I included in two ligatures, and divided it between them. The whole mass being now fully exposed, I proceeded to dissect it out from before backwards, feeling with my left forefinger for the vessels, so as to protect them from risk of injury. On clearing and raising outwards the anterior portion of the growth from its deep connections, the carotid artery and pneumogastric nerve were seen bare, as if dissected from their sheath, but the internal jugular vein could not be seen, and the pneumogastric lay somewhat in front of the carotid at its lower part. As I could neither see nor feel anything of the internal jugular, I next dissected the tumour from its posterior aspect, and then from the subclavian space, cutting with the edge of the knife close towards the deep surface of the growth, so as to avoid the phrenic and sympathetic nerves and the thoracic duct in the deep dissection at the inferior region of the neck. At one part the tumour was closely adherent to the fascia over the upper part of the scalenus anticus, but by dissecting the fascia from the muscle the whole growth was removed entire.

The parts now represented a deep dissection of the whole side of the neck, but no trace of the internal jugular vein in its natural relation could be seen, and it was concluded that the vein tied on the surface of the tumour was the jugular. There was very little bleeding, only a few small arteries requiring

to be tied ; but the last touch of the knife, separating the tumour, divided a small vein, which retracted between the transverse processes of the vertebrae, and as it could not be seized, the troublesome oozing from it required to be arrested by pressure. The surface of the wound was painted over with tincture of iodine, and the integuments were replaced and united by sutures, except at the posterior angle of the transverse incision, which was left open to permit any discharge to escape ; a compress of sponge, supported by a bandage, being placed over the wound to prevent venous oozing. The patient was then removed to the ward and placed in bed, his head properly supported. In the evening some recurrence of bleeding necessitated opening the posterior part of the wound. The bleeding was found to proceed from a small artery, which was tied. No further bleeding from the vein had taken place, and the wound was finally closed with sutures.

On the 13th the patient was pretty well. Pulse 100. Some nausea from chloroform. Ordered a saline aperient mixture.

14th.—Free from sickness ; bowels have acted freely ; tongue clean ; skin cool. Pulse 90.

15th.—Continues doing well. Pulse 84.

16th.—Pulse 76. Most of the stitches removed.

17th.—Incision along sterno-mastoid entirely united, as also the small incision at sternum. A good deal of healthy discharge from the transverse incision. Pulse 80.

20th.—Pulse 64. All ligatures except two have come away. Slight pressure with strapping to be applied over the corner of wound, near the ear, where pus has a tendency to lodge. Wound dressed with weak solution of tincture of iodine in water. From this time the patient's progress to recovery was uninterrupted. On 31st July the wound was healed throughout, except the surface of the cicatrix ; he was able to be out of bed and walking through the ward with the head unsupported ; and he was dismissed from hospital on the 24th of August.

The photograph showing the recently cicatrised wound left after removal of the tumour was taken on the 2d of August. (See plate XXXII.)

Examination of the Tumour.—The tumour, which presented an irregular modulated surface, was of somewhat ovoid shape, broader below than above, and of a uniformly firm consistence. On making a longitudinal section, it presented much the appearance of the section of a gland mixed with fibrous texture ; and, on more minute examination, it had all the usual characters of the adenoid growth. About the centre of the section two small portions had a dark bloody colour, and felt softer than the rest of the growth ; but on careful examination they were found to be essentially of the same structure as the rest of the tumour.

Commentary.—In my memoir of Mrs. Jepson's case I adverted to the want of success which has hitherto attended operations for the removal of such deep-seated cervical tumours, as I could find no record at that time of any case in which a large tumour situated under the sterno-mastoid had been completely removed, with ultimate success ; none, indeed, where complete removal had been effected. As it seemed to me that this want of success had led some surgeons to express strong opinions against operations for the removal of deep-seated cervical growths, I stated my opinion that the certainty of complete and safe removal of such tumours depended on the selection of proper cases for operation, by careful attention to the history of the case, and to the

diagnosis of the character of the growth ; for if the tumour was of slow growth and simple character we could calculate on its comparative definition and circumscription. I mentioned that these were the conditions which decided me in operating in Mrs. Jepson's case, although other surgeons had declined. Contrasting the history and vital manifestations of the tumour in her case with those of the cases operated on by John Bell, Warren, and Liston, in which complete removal had been found impossible, and in which the growth had returned, I pointed out that the histories of the latter cases showed evidences of malignant character, which, in my opinion, rendered operation improper in the present state of our knowledge ; but that, so far from deterring from operative interference in favourable cases, they rather gave encouragement, by showing how much could be done even under unfavourable conditions.

Unfortunately, the proportion of malignant cervical growths is much greater than of those suitable for interference. Out of a very large number of such tumours which I have seen, especially since the successful operation on Mrs. Jepson—with the single exception of the present case—I have met with none in which operation would have been warrantable (I do not include ordinary parotid tumour), as they were all marked by the characteristics of malignancy.

When the tumour has been of rapid growth from the first, is of irregular consistence, and presents the general features of malignant disease, I believe that the propriety of operative interference is very doubtful, as the chances of complete removal and ultimate successful issue are very small. Even though there be considerable mobility and apparent definition, such growths very generally arise from or involve at an early period the transverse processes of the vertebræ, whilst their superficial margins feel loose and defined. Mobility of the tumour, though an important consideration in deciding on the question of operation, is only of real value when taken in conjunction with the nature of the growth. A malignant tumour may not only adhere to, but involve, the great vessels and nerves, and yet be very movable, for these structures, being loosely connected in front of the vertebræ, move readily along with the morbid mass. In my remarks on Mrs. Jepson's case, I entered so fully on the special circumstances to be considered in deciding on the propriety of operating, that I would merely refer to it for information on these points, and limit my further observations on the present case to peculiarities in regard to its anatomical relations.

In the lad Manson, though the tumour was a very large one, it was entirely confined to the region of the neck, and hence did not give rise to the same amount of deformity as in Mrs. Jepson, in whom the growth occupied the parotid as well as the cervical region. In Manson, however, the tumour passed lower down into the subclavian and sternal regions, and, from being placed on the left side, lay in a position to press upon the thoracic duct and left recurrent nerve ; whilst the texture covering it in the sternal fossa rendered it impossible to ascertain positively its definition or attachments there. The perfect nutrition of the patient, however, showed that, though in close relation with the thoracic duct, it could not have involved that structure ; and though

the spasmodic difficulty of breathing at night, which he occasionally felt, might be due to pressure on the left recurrent laryngeal, the symptom was only of recent occurrence and not constant, and hence was more likely to arise from pressure owing to the proximity of the tumour, than from the nerve being involved in or adherent to it. These considerations, taken in connection with the simple nature of the growth, and its origin high up in the neck, seemed to warrant the conclusion that its substernal portion was free, and merely bound down by the fascia and muscles.

During the operation some peculiarities showed themselves, which I think worthy of notice, as exemplifying the difficulties we must be prepared for, and the care required in such operations, or rather dissections of the neck. When the anterior margins of the tumour had been freed, and its deep surface dissected and raised off from the position of the carotid sheath, the whole length of the cervical portion of the carotid artery and vagus nerve was seen bare, as if dissected, but there was no appearance of the internal jugular vein. This made me proceed very cautiously, for two reasons: *first*, the great vein might be partly involved or displaced by the tumour, and thus liable to be wounded at some unexpected part; and *secondly*, by the absence of the vein the sympathetic nerve and thoracic duct were left uncovered, and these important structures, undistinguishable amongst the tissues discoloured by blood, were exposed to great risk of injury. The phrenic nerve, from its white colour and comparatively superficial position, was easily enough seen and guarded. Indeed, the absence of the vein from its natural position, and the uncertainty as to whether it might be displaced, I consider the most embarrassing condition in the operation.

In describing the operation, I have stated that on dissecting the flaps from the surface of the upper part of the tumour I tied a large vein, which I was inclined to think was the displaced internal jugular vein; and my reason for supposing this was, that the vessel could be traced from the angle of the jaw passing downwards over and partly in a groove on the surface of the tumour in relation with the deep surface of the sterno mastoid, and very much in the line of the jugular; but as it was obliterated about the middle of the neck its continuity could not be traced lower down. The pervious portion was about the bulk of the forefinger, and full of blood for about two inches, when it became a flattened cord. I should presume, from the relations of the tumour, that it had probably originated at an earlier age even than that stated, viz. the third year, when it was first noticed by the patient's friends, and that it had developed itself from above downwards, and thus insinuated itself between the parts which usually occupy the common sheath, raising the vein on its surface and pressing the artery and vagus inwards, before its bulk overlapped them. I draw attention to this point, because it is well to be prepared for similar difficulties; and I believe that the history of the case may guide us, as these anatomical relations seem to me to depend specially on the original position and development of the growth in early life, before the cellular texture of the common sheath has become condensed, and are not likely to be met with in cases where the tumour

commonly at a later period of life; for, as a rule, a simple tumour, whilst it may adhere to, or compress, or push aside structures, has no tendency to destroy texture or separate parts contained in a common fibro-cellular sheath.

In conclusion, I may state that neither in Manson nor Mrs. Jepson was the division of the sterno-mastoid attended by any malposition, or even by any interference with the movements of the head; nor was the section of the cervical portion of the spinal accessory nerve followed by any appreciable bad effect. Both these patients remain perfectly free from any return of the tumour.

MALIGNANT TUMOUR OF NECK, REMOVED BY OPERATION.

Case of J. M'G.

Although I have been consulted in many cases of deep-seated malignant tumours of the neck I have hitherto resisted the temptation of operating, except recently, in one instance, which may serve as a contrast to the successful cases referred to. In this instance the patient was a young man, 25 years of age, and although the history of the growth and the anxious expression of his countenance indicated malignant nature, his general health had not suffered much. The tumour occupied the anterior and upper part of the neck from the angle of the jaw to the level of the cricoid cartilage, but niching itself deeply under the sterno-mastoid muscle. It was more prominent below than at the jaw, and projected from under the edge of the mastoid, and felt rounded and defined there, but apparently adherent to the textures over the side of the thyroid cartilage. The general appearance of the tumour and expression of the patient are well shown in fig. 192. The tumour had attained its present size in seven months, and was of stony hardness; latterly it had caused great pain and increasing laryngeal irritation. Under these circumstances, as the skin was healthy and the growth seemed as yet more than usually defined, and the patient's state seemed so painful and hopeless, I determined to attempt its removal. This I effected, but it was a far more tedious and dangerous procedure than in the larger simple tumours. I found it closely adherent to the side of the larynx and pharynx. It extended as deep as the atlas vertebra, and at different points it adhered to the sheath of the common carotid artery and internal jugular vein, and higher up to fascia covering the external and internal carotids, so that all



Fig. 192

these important structures were laid bare during the operation, and some of the muscular fibres of the inferior constrictor of the pharynx were so involved that they required to be removed with the growth. For some days the patient progressed very favourably, but subsequently considerable amount of irritation and suppuration took place in the vicinity of the pharynx. This was relieved, but oedema glottidis supervened so rapidly and unexpectedly, that the patient died before tracheotomy could be completed by the house-surgeon. A tube was introduced and artificial respiration used, but without avail.

It may seem that the fatal result here was due to accidental causes, such as its local position, etc., independent of the malignant nature of the growth, but it appears to me that the nature of the dissection requisite for its complete removal, together with the irritable state of the constitution, had very obvious bearing on the result.

DEEP-SEATED ADENO-CYSTIC TUMOUR OF NECK.

J. W., aged 56, admitted 21st March 1881.

Patient, a well-nourished man, free from any cachectic appearance, was found to have a tumour growing from the right side of his neck, extending from within half an inch of the middle line to the posterior border of the sterno-mastoid muscle, and from the angle of the jaw to the level of the cricoid cartilage. It was covered by the sterno-mastoid, beneath which it appeared to be freely movable. To the touch it was elastic, indistinctly lobulated, and painless. There was no interference with either arterial or venous circulation. It had commenced a little more than a year previously as a small hard swelling, and within the last five months had increased pretty rapidly.

On the 23d March it was removed in the following manner by Professor Spence :—

An incision was made along the anterior border of the sterno-mastoid, and another extending forwards at right angles, near the level of the upper border of the thyroid cartilage.

Ultimately a third incision, converting the whole into a crucial form, was made as far backwards as the posterior border of the sterno-mastoid, to give room for the necessary dissection. The growth was seen to be composed of an aggregation of cysts, and its removal was commenced at its anterior margin. On raising this its deep surface was found adherent to the carotid sheath, and much care was necessary in freeing its connection for the extent of about an inch and a half from the internal jugular vein. The facial vein—crossing at this point—could not be freed from the tumour, and was accordingly divided between a double ligature.

The anterior part of the tumour could now be raised from its dangerous connection with the vessels, which were by this time freely exposed in the wound, as well as the descendens noni and hypoglossal nerves. It now only remained to free the posterior part lying under the sterno-mastoid. In doing this a cyst was found embedded in the fibres of the muscle. To remove this thoroughly necessitated a pretty free division of the muscular fibres, and likewise the removal of a portion of the spinal accessory nerve which was embedded in the mass. One or two small bleeding points were now secured, the incisions closed with catgut sutures, and a drainage-tube inserted into the cavity of the wound.

About two hours after the operation, there was considerable venous hæmorrhage, which was arrested by compress and elastic bandage.

CLINICAL CASES.

March 24th.—The wound was dressed. Temperature, 99·6 ; pulse, 84. Oozing had ceased, but compress was continued.

March 26th.—Wound healthy, but tongue furred, and complains of headache. Temperature, 99·6 ; pulse, 88. Is sleepless.

March 27th.—Wound is healing kindly.

March 28th.—Patient has marked symptoms of melancholia, and has delusions that he is condemned to death, and suchlike. The wound still progresses well. The incisions have healed except at the central part, and are dressed with collodion and fine wool.

March 29th.—His general health has improved. Temperature, 99·4 ; pulse, 82.

March 31st.—Melancholia is passing off ; wound almost healed. His condition progressed favourably till the day of his discharge, on the 13th April, there being one small superficial granulating point at the centre of the incision. It was considered advisable that patient should leave hospital, owing to the still depressed state of his mind, and be put under the supervision of his friends.

When I heard of the patient recently the melancholia had completely disappeared, and the mental condition was normal.

THYROID TUMOURS.

HYDROCELE OF THE THYROID GLAND. LARYNGO-TRACHEOTOMY.

F. O.—This patient first came under Mr. Spence's care in January last, on account of a cystic tumour of the thyroid gland, which speedily yielded to blistering and the internal use of iodide of potassium. On July the 3d, he again presented himself, and was then suffering from considerable embarrassment of respiration, with occasional paroxysms of dyspnoea. Speaking, even for a short time, brought on violent fits of coughing, unaccompanied by expectoration. On examination, a tumour was found occupying the position of the isthmus and left lateral lobe of the thyroid gland, pushing the trachea backwards and to the right side, and extending downwards apparently behind the sternum and left clavicle, as was indicated by dullness on percussion and absence of respiratory murmur over the upper sternal and inner part of the clavicular and subclavicular regions. The chest was otherwise normal ; the superficial veins of the neck were much enlarged ; the left pupil was distinctly contracted. The treatment again pursued was blistering, and the administration of the iodide of potassium, but on this occasion without any good effect, as the fits of dyspnoea became more frequent and more severe. On the morning of the 11th, a violent paroxysm suddenly coming on, I was hastily summoned, and finding the patient's countenance turgid and livid, his respiration stopped, and his pulse scarcely perceptible, and believing that the immediate cause of his impending death was spasm of the glottis, at once determined to perform laryngo-tracheotomy. From the position of the larynx and trachea, the necessary incision, having to be made considerably to the right of the mesial line, laid bare the anterior margin of the sterno-mastoid muscle, and involved several enlarged veins. After the operation was finished it was found necessary to inflate the lungs through the tube, and keep up artificial respiration. The patient now rallied in some degree, but it was evident there was some obstruction below the opening made into the trachea. Accordingly, the tube was withdrawn and the trachea explored by the finger, when a convexity of the left side was discovered, so considerable as materially to diminish its calibre. A piece of gum-elastic tubing, of large bore, was now passed down beyond the obstruction, and its introduction was

followed by instant relief to the patient. Next day Mr. Spence examined the tumour by passing his finger through the wound, and, detecting fluctuation, made an opening at that point, when a large quantity of clear fluid was evacuated. He next made a counter-opening by cutting down on the point of his finger, passed downwards and to the right side, through the opening made from the tracheotomy wound. The finger was now passed through the second opening downwards, behind the left sterno-clavicular articulation, but failed to reach the bottom of the cyst. After the evacuation of the fluid the patient could breathe quite freely through an ordinary tracheotomy tube, which had been substituted for the gum-elastic one. On the following day symptoms of acute pyæmia set in, and the patient died on the evening of the 15th. On *post-mortem* examination, numerous metastatic abscesses were found in the lungs and liver.

E. F., æt. 27.—**HÆMATOCELE OF THE THYROID GLAND**, of five years' standing. This tumour, which was tense and elastic, as if containing fluid, although of very considerable size, caused no inconvenience to the patient, who applied for surgical interference merely to be rid of the deformity. On puncture by a trocar and canula, a quantity of bloody serum was evacuated; but as little subsidence of the swelling followed, a free incision was made into the cyst, which was found filled with clots of blood. These were turned out by the finger, and the cavity stuffed with lint. Suppuration and granulation of the cavity followed, and some thickening which remained yielded to blistering and painting with iodine.

A. J., æt. 11 years, came to the hospital on the 10th of June, with a tense elastic tumour occupying the supra-sternal hollow at the root of the neck, and extending upwards to the isthmus of the thyroid gland. This, first noticed about two months before, when it was of small size and caused little uneasiness, had increased considerably of late, and was now materially interfering with respiration, from its pressure on the trachea. The voice was considerably affected, the respiration was stridulous, and at intervals there occurred paroxysms of dyspnoea, threatening suffocation. After two days' observation, as the patient's symptoms became more severe, Mr. Spence made a longitudinal incision through the integuments in the middle line of the neck, and carefully dissected down to the tumour, which proved to be an abscess in the midst of the thyroid gland tissue, extending downwards and backwards behind the manubrium. Evacuation of the matter gave immediate relief to the patient, who left the hospital well a few days after.

AIR PASSAGES.

TRACHEOTOMY FOR REMOVAL OF FOREIGN BODIES.

CASE I.—On the morning of Thursday, the 23d of September 1841, I was sent for in great haste to see a child, who, according to the statement of the messenger, "was suffocating from something sticking in the throat." On reaching the house, which was situated in the immediate vicinity, I found the patient, a boy about the age of four years at most, asphyxiating; his face was much swollen and livid, the eyes were protruding, and the veins of the neck turgid, with the nostrils dilated. The respirations were prolonged, and accompanied with a peculiar stridulous noise. The mother of the child told me that, on the previous evening, having to go from home, she left the child in care of another woman, and that she had, before going away, given the

child some small plums, while eating which he was observed to cough violently, and roll himself on the ground; and on recovering from this state, he mentioned that he had swallowed one of the plum-stones; but as no further symptoms occurred at that time, no notice was taken of it. He continued quite well, and slept as usual during the night, and took his breakfast the following morning; but shortly before I saw him, and whilst playing about the room with the other children, he, on a sudden, cried out that he felt the stone in his throat, and almost instantly fell down in the state of suffocation which I have already described. Although I had no doubt whatever as to the foreign body being in the windpipe, yet, to make assurance doubly sure, I passed a probang down the œsophagus. This met with no obstacle in its passage, and, as I expected, afforded no relief. As the symptoms, therefore, were most urgent, the extremities becoming cold, and the pulse intermitting, I stated to Mr. Lawrie, surgeon, who was present, that I considered the operation of tracheotomy as the only chance of saving the child. Mr. Lawrie concurring in this opinion, I performed the operation, which was accomplished without greater difficulty or delay than what might be expected from the want of assistants and the struggling of the child. On the trachea being opened, a quantity of frothy mucus was forcibly ejected, but no foreign body. Through the opening, however, the child breathed freely, and the face soon resumed its natural appearance. After waiting a few moments I passed a slightly bent probe upwards into the larynx, and downwards into the bronchi, but could not detect any foreign body. I therefore introduced a small trachea tube, and left the child in charge of my friend Dr. Smith, until I could procure instruments for extraction. At 11 A.M. I again saw the child, along with Professor Syme, who, kindly attended at my request. The child then breathed easily through the tube; but when it was removed and the opening closed, there was great difficulty in respiration.

The edges of the opening being held aside by small hooks, I again carefully examined both the larynx and bronchi with a probe, but most particularly the larynx, for all the symptoms tended to impress us with the belief that the foreign body was there. Mr. Syme also examined the parts, but could not detect it. It was agreed in consultation that it was best to enlarge the opening. I therefore divided the cricoid cartilage so as to allow a more ready examination of the larynx, and a more easy escape of the foreign body; but we were still unsuccessful. Under these circumstances we deemed it best to replace the tube until the following day. Nothing particular occurred during the remainder of the day; the child was carefully attended to, he continued to breathe freely through the tube, and both sides of the chest seemed to expand equally, and at the same moment. He was ordered a little milk with warm water and sugar, for food, which he partook of readily, and slept at intervals. On Friday, Professor Syme again saw him with me; the tube was withdrawn, but the difficult respiration again returned when the opening was closed; whilst, on the contrary, the breathing was free and perfectly easy when it was left open. We again carefully examined the larynx and bronchi, but in vain. We could not detect any foreign body; and we concluded that it had probably been pushed up by the probe, passed into the pharynx, and swallowed, and that the difficulty in breathing might be owing to swelling of the mucous membrane lining the larynx. The tube was once more replaced, and the same treatment adopted as before; a gentle laxative was prescribed, and I desired the stools to be carefully examined. I again saw him at three P.M., when I found his breathing was hurried, together with a considerable degree of general fever; the face was flushed, and the pulse rather quick and hard; I therefore ordered some leeches to be applied

over the region of the chest, the laxative medicine to be repeated, and an injection to be given in case it did not soon operate.

I again saw him at 8 P.M.; he now seemed considerably easier, there was less fever and restlessness, and the breathing was less hurried; the bowels had been freely opened, and the leeches had bled well. At 10 o'clock I was informed he was rather worse; and on visiting him I found him very restless, his breathing had become hurried, and he was thirsty and hot. Having cleaned the tube, it relieved his breathing; and I left him, and sent a person to remain with him during the night, with strict instructions to call me if he became worse. At half-past 11 o'clock I was again sent for, as the child had become suddenly much worse. I now found him fast sinking. I introduced a clean tube, and ordered him some wine and water, under which he rallied in a measure; but it was only for a short period, as about midnight he expired.

Having obtained permission from the friends to examine the body, I did so on the morning of the 26th September, and the following were the appearances found on dissection:—

Post-mortem Examination of the Body.—I carefully examined the larynx and trachea, but could find no foreign body. There was a slight degree of vascularity of the mucous membrane of the larynx, together with some thick mucus in its cavity, but there was very little swelling of the parts.

I laid open the right bronchial tube, which presented nearly its natural appearance, with but slight degree of vascularity of its mucous coating, but there was no foreign body in it. The right lung, with the exception of a little congestion at its posterior part, was of a healthy appearance, and crepitated naturally on being pressed between the fingers. The left bronchus was next examined; and as I saw no foreign body, I was about to give up all further investigation of the thoracic viscera, concluding that it had been pushed upwards during our examination of the larynx, as I previously conjectured, and that it passed into the stomach, when my attention was arrested by the peculiarly dark appearance of the lower portion of the upper lobe of the left lung; and on cutting into this portion I found the foreign body, a small damson-stone, impacted into one of the large subdivisions of the left bronchus, the larger end of the stone projecting upwards. No other parts were therefore examined.

Remarks.—In reflecting on the case which I have just detailed, some phenomena of a very unusual kind present themselves. In the first place, when we regard the history of the case given by the child's mother, the sudden manner of the attack, together with the urgent symptoms of asphyxia when first seen, and the almost immediate relief afforded by opening the trachea, although no foreign body was expelled; and if we add to this that while the child breathed freely through the tube, both sides of the chest seemed to expand equally, and at the same moment; but that, on the other hand, whenever the tube was removed, and the opening in the trachea closed, difficult respiration ensued;—I think few medical men would hesitate to pronounce as their opinion that the foreign body was entangled in the larynx; and yet the case just narrated affords an example of all these symptoms being present, whilst the foreign body was impacted in one of the ramifications of the bronchus. It may indeed be urged, and I confess I cannot quite divest myself of the idea, that the foreign body was in

the larynx when the child was first seen, and had thus given rise to the very urgent symptoms which led me to operate; and that, owing to the struggles of the child during the operation, it had been dislodged from the larynx, and passed into the bronchus. Still, allowing this supposition to be true, it leaves unexplained the cause of difficult respiration which constantly ensued on withdrawing the tube and closing the opening in the trachea. This is perhaps the most peculiar feature of the case; and I can only attribute it to the irritation caused by the presence of the foreign body being conveyed along the nerves distributed on the mucous lining of the bronchus and trachea, towards the larynx, and so exciting spasmodic action of the muscles which close the glottis.

Last, but not least in point of practical interest, is the unusual situation of the foreign body in this case; for, so far as I am aware, there is no case recorded in which a large-sized foreign body has found its way into the left bronchus. Indeed, most writers on the subject speak of the foreign body passing down into the right bronchus, as if it were a constant rule.

As regards the extraction of a foreign body, if discovered under similar circumstances, I should think it, to say the least, exceedingly difficult; for in a child at that age the trachea and bronchi are so small as to afford but little room for the use of forceps or other extracting instruments. I believe that the only chance in this case of extracting the foreign body would have been (had its situation been discovered) to have loosened the foreign body from its position in the orifice of the bronchial ramification, by means of the flat end of a long probe, so as to allow the air to pass into the portion of lung beyond it, when it would probably have been expelled during expiration. For, of course, whilst it remained impacted in the bronchial ramification, it must have caused complete occlusion of that portion of lung to which that division of the left bronchus was distributed.

CASE II.—A fine little girl, 4 years of age, the daughter of a medical man in the country, was eating damson-jam, when one of the stones, which she had been sucking, suddenly slipped into the larynx. A violent paroxysm of cough and dyspnoea, threatening suffocation, immediately ensued; but the foreign body passing downwards, temporary relief was obtained. As similar paroxysms recurred, the father telegraphed to town for Professor Goodsir and myself to come out immediately.

When we arrived we found that she had had some severe paroxysms, and that the means used by her father, and Dr. Baird of Linlithgow, who had also seen her, had failed to cause ejection of the foreign body.

Under these circumstances, and as the movement of the body in the trachea during respiration could be distinctly heard, we at once proposed tracheotomy, which indeed was the object of our being sent for, and therefore there was no delay.

The use of chloroform was tried at the request of the friends; but it excited such a tendency to suffocation that it was given up, and I proceeded to operate at once. Owing to the bulk of the thymus gland, the numerous dilated veins, and the presence of the middle thyroid artery, the operation required some care, but the parts were so distinctly seen that it was not prolonged.

I made a long incision into the trachea, and inserted the points of my dissecting forceps at the upper part, expanding their blades to keep the orifice patent; on doing this, and raising the head, a quantity of mucus was ejected; then the plum-stone was seen to be forced towards the opening. But, unfortunately, at this moment inspiration took place, and the rush of entering air carried it back.

We attempted to cause its expulsion by inducing coughing, and by shaking, and altering the position of the little patient, but in vain. On examining the chest it at once became evident that the stone had become impacted; for while the right side expanded on inspiration, the left was flattened and immovable, the lower ribs being drawn forcibly inwards, and the respiratory murmur entirely absent.

By means of flattened probes passed along the left bronchus, we attempted to reach the stone for the purpose of dislodging it; and we tried to procure its expulsion by moving the thoracic parietes, and by every means we could think of, but without success.

In consultation it was determined to take the child to town with us next morning, and try if any plan could be devised to loosen it by instruments or by suction.

Having brought the patient to Edinburgh, a great variety of means were tried, but with no better result; and after a few days' illness the child died.

On examination after death, the damson-stone was found impacted in the left bronchus, fairly filling it up, like a cork, and preventing all entrance of air into the left lung, which was flaccid and collapsed; the thoracic parietes of the left side, as seen during life, were contracted and flattened. The child, at the time of the accident, was just convalescing from a severe attack of pneumonia of the right lung, the lower part of which had suffered so as to be hepatised, while the upper part was engorged with bloody serum, and the bronchi loaded with mucus; so that the child died more rapidly than would have been the case had the right lung been healthy.

Remarks.—The foregoing case presents several points of interest. 1st, The direction in which the foreign body was carried; 2d, Its impaction at the termination of the left bronchus, and the complete occlusion of the tube and collapse of the lung thereby occasioned; and 3d, The question as to what means can be suggested for the treatment of similar cases.

In regard to the first of these points, it is very generally stated that foreign bodies entering the air-passages pass into the right bronchus; this, and the preceding case, however, show that there is nothing to prevent a foreign body passing down the left bronchus.

As to the second, in the case just narrated the plum-stone was much larger than in the former case, and was so placed as completely to prevent any air from entering the left lung, and hence to preclude any chance of its being forced out by an effort at expiration; the marked flattening and other symptoms leaving no doubt as to its position, or as to the collapse of the corresponding lung.

Third, as to the treatment. I have always regretted that chloroform should have been given in this case, for I think that the condition it induced rendered the expulsive efforts less forcible than they usually are in such cases. The appearance of the foreign body was so momentary that there was no time to seize it, even if we had not expected

that it would be forcibly expelled. The manner in which it was carried back into the bronchus, and the evidently complete occlusion of air from the left lung, rendered all chance of its expulsion hopeless; and therefore no time was lost in trying, by the means already mentioned, to loosen it from its position, so much at least as to admit air along its side into the lung beyond, and so favour its expulsion. This was principally attempted by the use of flattened probes; but we felt at the same time the risk of impacting the stone more firmly, and therefore great care was taken to keep the flattened probe close to the sides of the tube in passing it. As I have said, neither this, nor inverting and shaking the patient, produced any effect. In the subsequent attempts the application of some suction power, applied through a tube passed down the bronchus, was suggested; but in consultation it was agreed that the irritation to the passages by these manipulations would be productive of more harm and risk than its chance of success could compensate for, and that, by leaving the child quiet for a time, the body might become loosened by the changes induced by its own presence. Unfortunately, however, the state of the right lung precluded the chance of the success of this plan, which, under ordinary circumstances, I believe would be the wisest to adopt.

As to other methods, in my remarks on Case I., I have stated my opinion that, even if we were sure of the position of the foreign body, the small size of the passages renders the introduction of extracting instruments impossible, and that, unaided by the natural expulsive efforts, artificial means would be very inefficient; and I regret that my experience in this second case does not enable me to alter my opinion.

CASE III.—*Madeleine H.* was admitted into the Royal Infirmary on the 29th of June 1857.

About three hours before admission, while she was playing, with a plum-stone and a cherry-stone in her mouth, they both suddenly slipped down her throat; this was followed by a convulsive fit of coughing, and she was found by her mother lying on the ground in a paroxysm of dyspnoea; the plum-stone was lying beside her, but the cherry-stone could not be found. I saw her at her house; but, as the urgent symptoms had disappeared, and there seemed some doubt as to the history of the case, I sent her to the Infirmary to be carefully watched.

On admission she had an occasional slight laryngeal cough, pain on pressure over the larynx, and an apparently altered tone of voice, but no difficulty or noise in breathing, and no sign of the presence of a foreign body could be detected by the stethoscope.

During the night she was constantly watched, in case of asphyxia occurring suddenly. She slept quietly during most of the night, but towards morning had several very alarming attacks of dyspnoea, so much so that tracheotomy was twice about to be performed.

Next day she was much in the same condition; and after consultation tracheotomy was decided upon, and forthwith performed. After the first incision a severe fit of coughing came on, and the dyspnoea was so great that the operation was rapidly concluded on account of threatened asphyxia. As soon as the windpipe was opened, and the edges of the incision separated, the foreign body was forcibly ejected by a violent expiration, and the breathing immediately became perfectly calm. A tube was introduced, but removed

after three hours, the breathing being quite easy, and chiefly by the natural air-passages after its removal.

On the following day the edges of the wound was approximated by a strip of plaster ; the breathing was calm, and almost entirely through the larynx.

The wound gradually closed, the patient's convalescence was uninterrupted, and she was dismissed cured a week after admission.

Remarks.—This case is instructive, as exemplifying the uncertainty which sometimes exists as to the presence of the foreign body.

The accident frequently occurs when the child is playing ; the child is suddenly attacked by a convulsive cough and threatened suffocation. On recovery from this paroxysm it says it has swallowed a plum or cherry stone ; but, as the symptoms pass off, and the breathing and speech become natural, the friends think that the foreign body has either been swallowed or coughed up, and that the danger is past ; and medical aid is deemed unnecessary till another paroxysm of threatened asphyxia suddenly occurs. Such was the history in the case last narrated ; but this case was even more complicated, because the convulsive cough had expelled the plum-stone, and there was therefore a probability of the smaller body having also been expelled.

When I saw the patient, her breathing was easy, both sides of the chest expanded naturally, her voice was quite natural, and she spoke freely. The only positive symptom was a somewhat croupy sound when she coughed ; but her mother stated that any cold or irritation always produced that symptom in her ever since she had had whooping-cough, two years before.

On examination with the stethoscope over the trachea and chest, neither my friend Dr. Dunsmure nor myself could detect any sound indicative of a foreign body moving in the air-passages. I thought, indeed, that there was a peculiar sound a little below the right sternoclavicular articulation ; but nothing decided, or at all like what I have heard in other cases of foreign bodies in the trachea. But, in opposition to the view that the stone had been expelled, the girl stated that she felt the cherry-stone go down when the plum-stone was expelled, and that she still felt it at times in her throat (pointing to the trachea). The cherry-stone could not be found anywhere near where she had been playing ; and Mr. Adams, a young medical man, who first saw her, distinctly stated that the symptoms were those of a foreign body having passed into the trachea.

Under these circumstances, having everything prepared for tracheotomy, we determined to ascertain the presence of the foreign body by inverting the patient and shaking her, so as to throw the stone (if in the air-passages at all) towards the larynx, and render the symptoms of its presence unequivocal.

This was a somewhat hazardous experiment, but safer than leaving the question in doubt.

As even this manoeuvre produced no cough or paroxysm, our doubts as to the presence of the stone in the trachea or bronchi became greater. I therefore recommended that she should be taken to my wards in the Infirmary, where she would be carefully watched, and where surgical aid could be had at once, if necessary.

I saw her twice during the evening, while she was asleep, and her breathing was then quite calm and natural. The occurrence of the paroxysms of suffocative cough during the night left little doubt as to the propriety of tracheotomy, and the operation was at once decided upon in the consultation, although at that time she was again quite free from any urgent symptom.

In cases like this, where there is considerable doubt as to the presence of the foreign body, it may be deemed advisable to wait, if the patient be placed in such circumstances that tracheotomy could be immediately performed should symptoms of suffocation supervene; but I confess that my experience in this case would lead me, notwithstanding the negative evidence afforded by auscultation, to urge the performance of the operation, so as to place the patient beyond the risk of a sudden fatal paroxysm, such as happened in the case alluded to in the Medico-Chirurgical Society by Dr. W. T. Gairdner, where a child, in very similar circumstances, died in the hospital before the house-surgeon could reach the ward.

Doubtless there are cases on record where foreign bodies have passed into the bronchi, and have, after a time, been ejected by coughing; and sometimes this has occurred even after tracheotomy had been performed without success. But such rare exceptional cases can never form a rule for practice; and, to say nothing of the immediate risk of asphyxia, the continued irritation induced by the presence of even a small foreign body is almost certain to induce disease in the lungs, and ultimately to destroy life. In a female said to have died from phthisis, with constant cough, I found thickening of the tracheal mucous membrane, and, on opening the larynx, discovered in one of the ventricles the pip of an orange, partly confined in its position by bands of lymph. The history of the case, so far as it could be traced, left but little doubt that the irritation of the foreign body had been the origin of the pulmonary disease. But the propriety of operating early in such cases is now so generally admitted that I need not insist on it.

In performing the operation in such cases, it is of great importance to hold the incision in the trachea widely expanded, as the elasticity of the rings tends to close it, and so to impede the expulsion of the foreign body. In former cases I have inserted the points of my dissecting forceps, and then expanded the blades; but in this case I adopted the simpler plan of inserting the thin ivory handle of the scalpel I was using, and then turning it flat at the upper part of the incision; it thus widely expanded the tracheal opening, occupied the least possible space, and effectually prevented any risk of a foreign body passing from the larynx into the bronchi; whilst it also gave distinct evidence that the cherry-stone must have been in the trachea, and not in the larynx, as the peculiar cough had led us to suspect.

PORTION OF TRACHEOTOMY TUBE IN BRONCHUS—EXTRACTION.

G. F., aged 33, came to the hospital on June 4th 1868, stating that, about half-an-hour before, the shield of a tracheotomy tube, which he had worn

for the last twelve months, had suddenly become detached, and that the cylindrical portion had slipped down into his windpipe. He pointed to a spot corresponding to the bifurcation of the trachea, and said he felt the tube there. He spoke and breathed without difficulty; and the only signs of irritation were severe fits of coughing, recurring at frequent intervals. Mr. Spence having introduced a gun-shot probe into the trachea, guided it into the right bronchus, but failed to discover any foreign body. The left bronchus was next explored, and then the probe was distinctly felt and heard striking the metallic tube. Chloroform was now administered, and the opening into the trachea having been enlarged, a forceps with blades bent almost at a right angle, was guided downwards into the bronchus, and passed *within* the tube with the blades closed. The blades of the forceps were next *forcibly expanded*, and the tube thus caught was readily extracted, with immediate relief to the patient, who left the hospital quite well four days after.

Remarks.—"All that need be remarked concerning the case of G. F. is, that the tube was readily extracted owing to the happy way in which it was caught, and that in this, as in the majority of such cases occurring in the practice of Mr Spence, the foreign body was found impacted in the *left bronchus*, and *not in the right*, in which, according to the statements in books, foreign bodies more frequently lodge."

In June 1862, I received from a former pupil, the late Dr. Temple, a preparation of the larynx and trachea of a boy who had died suffocated. A quantity of half-masticated food is impacted in the larynx and upper part of the trachea. No portion of the mass is above the level of the upper part of the thyroid cartilage, and therefore, as the accompanying history of the case shows, could not have been felt from the mouth.¹ The preparation is in my private museum.

The patient was a boy about 12 years of age. When first seen he seemed to be dying asphyxiated, and supposing it might be from spasm of the glottis, I had the patient immediately placed in a warm bath which was standing ready, and a jug of cold water poured upon his head. The shock partly restored consciousness, and on being asked if he were suffering pain, replied "Here" (in a very husky voice), pointing to his throat, then died instantly. The finger had passed the throat, but nothing could be found obstructing the gullet. The parents stated that he had had somewhat similar attacks before, and always spoke in a husky tone of voice. Whilst sitting at dinner he was seized with what they considered one of the attacks to which he had been subject. Only a few seconds could have elapsed between his being seized and being seen, and nothing had been done to the boy before my arrival. On dissection, the carotid artery of the right side was found crossing the trachea immediately at the situation where the incision would have been made in performing tracheotomy, and could scarcely have escaped being wounded or cut across, whilst the trachea itself was surrounded by an immense aggregation of enlarged glands, thus perhaps accounting for the husky speech by the pressure they had exerted on the recurrent laryngeal nerves.

¹ This is the exceptional case referred to at p. 875.

CASES OF TRACHEOTOMY IN CROUP.

CASE I.—John Blakeley, aged $4\frac{1}{2}$ years, was seized with hoarseness and pain in the throat on the 5th of April 1856. As he did not seem very seriously ill he was allowed to play out of doors as usual; but on the 7th the symptoms increased so much in severity, and were so evidently those of croup, that his mother applied for medical aid at the dispensary. He was accordingly seen, on the evening of the 7th, by Dr. Glen, then one of my dispensary pupils, and was ordered a warm bath and some medicine.

Next morning, when Dr. Glen saw him, he desired the mother to ask me to visit the child.

On going to the house I found the patient in great agony from dyspnoea. As there was no great amount of bronchitis present, and evidently no time to be lost, I caused the child to be brought to the hospital, which was in the immediate neighbourhood, and at once performed tracheotomy. Some mucus and shreds of lymph were expelled on introducing the tube; the breathing then became easy, the lividity of the face passed away, and the little patient seemed quite relieved.

He continued to progress favourably, and on the evening of the third day the tube was removed, but had soon to be replaced on account of threatened asphyxia. It was finally removed on the sixth day, after which the wound gradually healed, and the child was dismissed cured on the 28th of May. He has continued to enjoy excellent health ever since, with the exception of showing a susceptibility to hoarseness during damp weather.

For the notes of the following case I am indebted to my friend Dr. Wilson, and I give the report in his own words:—

CASE II.—"C. W., aged $3\frac{1}{2}$, was first seen by me on the 19th of September, on the second or third day of an attack of scarlatina. From my first seeing him the case presented a very bad aspect; the throat was considerably affected, and then a troublesome diarrhoea set in, accompanied by typhoid symptoms, for which he had very large quantities of wine, gradually increasing to 10 or 12 ounces a day, chlorate of potash, astringents, etc., which were evidently beneficial; and I was in hopes he was going to struggle through, when, at the end of the third week of the disease, he was seized with symptoms of laryngitis.

"These increased, and the case seemed hopeless if left to itself; but the disease being apparently confined to the upper part of the larynx, the propriety of operative interference suggested itself to me, and I determined to ask you to see him. This you most kindly did, accompanied by Dr. Watson, on the 10th of October.

"The child was much emaciated, and the pulse feeble; still, as the disease appeared to be confined to the upper part of the larynx, you resolved to give him the chance, though small, of the operation. Immediately after the operation the breathing became quite easy, and continued so till death, except on two occasions, when attempts were made to dispense with the tube, and the nurse was unable to introduce it on a paroxysm of dyspnoea ensuing, although the patient had been breathing easily during the time your assistant remained. He continued to take both wine and beef-tea in large quantities, and by injection; but the stomach began to fail, the pulse became feeble, emaciation progressed, and he died on October 15th, five days after the operation.

"On reviewing the operation at this distance of time, I have no hesitation in saying that the operation, though unsuccessful, was most beneficial, even allowing that it did not prolong life, which, however, I am inclined to think it did; still the relief afforded was so great that I would be inclined (however reluctant we must be to advise operations not likely to be successful), were a precisely similar case occurring to me, to recommend the performance of tracheotomy."

CASE III.—William Lindsay, aged 4 years, was seized with hoarse cough, sore throat, and occasional difficulty of breathing, on the 15th of October 1856. No treatment was resorted to till the 16th, when the symptoms became more severe, and Dr. Menzies was called to see him. He was then labouring under symptoms of croup; the stridulous breathing and paroxysms of dyspnoea occurring, however, at lengthened intervals. His pulse was very rapid and small. Leeches were applied over the neck, followed by a blister, and antimonial solution was ordered to be given at stated intervals.

On Sunday the 17th Dr. M. found the little patient so much worse that he requested me to see him, in case I might think it advisable to perform tracheotomy.

I found him suffering from very urgent dyspnoea, with prolonged stridulous inspiration and very short expiration. The expansion of the thorax was deficient, the ribs being drawn inwards during respiration. The pulse was small, and the face livid. There was some slight bronchitis, but not to such an extent as to forbid the operation, which was accordingly performed, and a double tube introduced. A quantity of mucus was expelled on opening the trachea, and then the breathing became easy. A piece of muslin was placed over the orifice of the tube, and the attendants were shown how to clear it from time to time.

In the afternoon, when I saw him, I found him much relieved. The colour of the face was natural; the pulse, though still quick, was softer, fuller, and less rapid than in the morning; the breathing was quite easy.

I removed the inner tube, cleaned it, oiled it slightly, showed the attendant how to remove and clean it, and made her take it out and replace it, to make sure that she understood me.

Next morning I found him still improving, and breathing so easily, that, after cleaning the tube, I did not think it necessary to visit him again that day.

On Tuesday the 19th, when I called on Dr. Menzies to accompany me to see the patient, I learned, to my great surprise, that he had died at 3 A.M. Dr. M. informed me that he had seen him after my visit, and found him still doing well, and breathing quite easily. About 1 P.M., however, owing to some mucus obstructing the tube, a fit of dyspnoea came on. The nurse, instead of withdrawing the inner tube, although she had been taught how to do it, became alarmed, and it was only when the child was nearly suffocated that his father, in desperation, took it out. This at once relieved the breathing; but the effects of long-obstructed respiration soon showed themselves in pain in the head, dilated pupils, and other symptoms of cerebral effusion. The poor child soon became comatose, and died thirty-nine hours after the operation.

CASE IV.—George Stark, aged 5 years, admitted to the Infirmary on the 19th March 1857.

The patient has been subject to cough for the last two years, and is liable to occasional acute aggravations of it. He was seized with one of these attacks

about a fortnight ago, and was considerably worse than usual. His symptoms became gradually more urgent, and he was brought to the hospital on the 18th of March, suffering from a severe attack of true croup. The usual treatment, including repeated counter-irritation, was used in vain, and on the 19th he was so ill that tracheotomy seemed to afford the only chance for life. The breathing was noisy and laborious, the respirations being 30 per minute; the expansion of the chest in inspiration was very imperfect, and there was marked depression of the lower ribs in expiration. The operation was accordingly performed in the usual way, and a double tube introduced. Great relief to the breathing immediately followed the operation.

20th.—Pulse 140; skin hot; but patient breathing much more easily. The tube is carefully kept clear. Since the operation considerable pain and tenderness have been felt below the left jaw.

22d.—Pulse 120, and skin cooler. The tenderness below the jaw has disappeared. Breathing very easy. The tube was taken out to-day, and did not require to be replaced.

25th.—Pulse 120, rather small; ordered 3ij wine. The tube required to be replaced, as the breathing was becoming impeded from the closing of the wound.

26th.—Tube finally removed to-day; doing well.

30th.—Pulse 100; breathing easy; general health very much improved.

April 6th.—Pulse 100, full and soft; general appearance much improved; and the tracheotomy wound is closing rapidly. The raw surface left after the repeated blistering is still sloughy and irritable.

10th.—Going on very well; wound nearly closed, and blistered surface healing.

20th.—Continues to improve.

29th.—Dismissed cured.

CASE V.—Margaret Kerr, 2½ years of age; was admitted into the Royal Infirmary on the 5th September 1857.

The patient was seized with symptoms of croup on the evening of September 2d, but was not alarmingly ill until the afternoon of the 4th, when medical advice was obtained.

In spite of the treatment adopted—warm bath, leeching, and blistering—the little patient got rapidly worse, and was brought to the Infirmary by Dr. Gordon in an extremely exhausted and almost moribund condition, at midday of the 5th instant.

Tracheotomy was performed by Mr. Spence without delay. There was no trouble from hæmorrhage; some shreds of lymph and a small quantity of mucus tinged with blood escaped at the moment of opening the trachea. A double tube was introduced, and secured behind the neck in the usual way.

The operation was followed by immediate relief to the breathing; but the extreme prostration, the lividity of the countenance, and the smallness of the pulse, passed off but slowly.

She was immediately put to bed in a warm room, hot bottles placed around her, and wine freely given. Under the use of these means she gradually revived; the face regained its natural colour, and the pulse became stronger.

For the first few hours after the operation she was constantly watched by a dresser, the tube kept clear with a feather, and the inner tube frequently removed to be more effectually cleaned. The nurse and the mother of the child were also taught how to do this.

Sept. 6th.—The tube has been constantly kept clear, and the breathing has been quiet and easy during the night, except from slight occasional attacks of dyspnœa from the imperfect expectoration through the tube. To-day the pulse is good, skin moist, and colour natural. The wine, which has been given in small quantities during the night, is to be discontinued.

7th.—Progressing very favourably; pulse full and rapid; skin dry. Bowels opened to-day spontaneously. Ordered small doses of ipecacuan wine to be frequently repeated; also a sinapism between the shoulders.

8th.—Going on very well. The tube was removed to-day; but it was necessary soon to replace it, as great dyspnœa followed any obstruction of the tracheal wound.

9th.—Tube removed to-day, and not replaced. She is breathing almost entirely by the natural air-passages.

12th.—Progressing very favourably; wound closing.

16th.—Report as at last entry.

26th.—Just recovering from a smart attack of dysenteric diarrhœa; wound almost healed; breathing calm and natural.

Remarks.—All these cases of croup present some symptoms in common—viz. dyspnœa, lividity of the countenance, deficient expansion and drawing in of the thoracic parietes during respiration, and marked stridulous breathing; together with paroxysmal exacerbations of the dyspnœa, gradually increasing in frequency and intensity. In none of them was there any great amount of bronchial affection; and, with the exception of the boy Blakeley and the girl Kerr, where some small shreds of lymph were expelled after opening the trachea, in none of them did the croupous exudation seem to have taken place to any great extent on the tracheal mucous surface, although the tenderness over the trachea prior to the operation, and the appearance of the lining membrane, as seen on opening the tube, proved that it was to some extent implicated. In these cases, therefore, the diseased condition may, for all practical purposes, be considered as confined to the larynx at the time when the urgent symptoms arose; and hence they all were in that respect favourable for giving the patients the benefit of the operation. In all, however, there was unmistakable evidence of bronchitis and bronchial effusion occurring subsequently from extension of the inflammation, most probably increased by the operation and necessary presence of the tube. Indeed, from what I have seen of cases of tracheotomy, even for the removal of foreign bodies, where of course no bronchitis existed prior to the operation, I have little hesitation in saying that bronchitis or broncho-pneumonia almost invariably occurs after it. I draw attention to this because bronchial effusion forms a most serious complication in very young children after tracheotomy, and is indeed one of the great objections to the operation in cases of croup. When present to any extent it has generally been held, in this country at least, to contra-indicate tracheotomy, and I think with good reason.¹ In children under three or four years of age, from the small size of the tube we can introduce, it is apt to become choked with the tenacious mucus, as happened in one of the cases narrated;

¹ It will be seen from the Lectures that further experience has greatly modified this opinion.

and as, of course, we cannot make the infant understand how to cause forcible expulsion of the mucus from time to time, by placing the fingers so as to diminish the orifice of the tube, or of the wound, as we can in older children or adults, such a case is entirely dependent on the care and experience of the attendant or nurse in the after-treatment; and the danger of extensive bronchitis in a child of that age, even apart from other complications, is too well known to need to be insisted on. In no operation, perhaps, do the chances of success depend more on the care and watching of the patient by experienced attendants than in tracheotomy. In looking back on the cases detailed, I cannot but think that had the patient Lindsay been in the hospital, the result would probably have been as successful as the cases of Blakeley and Stark; certainly his state at the time of the operation was fully as favourable, and when I last saw him alive he was progressing well. Indeed, the history of his case shows pretty clearly that the paroxysm of dyspnoea, owing to the obstructed tube, led to fatal cerebral congestion and effusion. In all cases, it is obviously desirable to remove the tube early; but the foregoing cases as well as other cases of tracheotomy, have shown me that you can never venture to do so without being prepared to replace it at any moment on account of some paroxysm of obstructed respiration; and this implies the necessity of having proper assistance at hand, a condition not easily attained in private practice.

The presence of any extensive exudation of false membrane must always be a formidable objection to tracheotomy. If partially loose, it may be so placed as to act as a valvular obstruction at the lower aperture of the tracheotomy-tube; and if the membrane exist in the complete tubular form, as in that state it is often but loosely attached, it may collapse on the trachea being opened, and cause immediate suffocation. If I am correct in holding the opinion that bronchitis or croupous exudation, when present to any extent, form objections to tracheotomy, it must be evident that very few of the cases which we see in young children admit of its performance with reasonable chance of success, except at a much earlier period of the disease than is generally thought proper to consider of its propriety in this country. In estimating the success of the operation for croup in France by M. Trousseau and other surgeons, we must keep in mind not merely the comparatively great success of what has proved by no means so successful an operation in this country; but, taking into account the early stage in which it has often been performed there, we must ask ourselves whether many of the cases might not have recovered under active treatment without such a hazardous operation. In very young children, under three years of age, besides other dangers incident to the operation at that period, the bronchitis which follows the operation must render the chance of success very small indeed, and the unfortunate results of such cases often prevent the surgeon being permitted to perform tracheotomy in cases proper for it. As to the question of the propriety of the operation in cases such as that of the child Walker, where the laryngitis supervenes during scarlatina, even though the operation, as in his case, may effect all the benefit we could expect in

relieving the dyspnoea, the state of the patient in other respects hardly affords much hope of recovery, and we can only regard the operation as a palliative. Viewed merely in that light, however, I think few who have seen a patient struggling in agony for breath would not feel satisfied even with the temporary relief afforded by the operation in that case; besides this further consideration, that without it there was no chance for life being prolonged even a few hours.

The case of the child Margaret Kerr, it will be noticed, stands as it were in opposition to some of the opinions I have expressed as to the performance of tracheotomy for croup in very young children, and in the advanced stage of the disease; for this infant, only $2\frac{1}{2}$ years of age, was almost moribund when I operated. But whilst such a case, to a certain extent, may modify the remarks formerly made, and affords encouragement to attempt relief even in very unfavourable circumstances, and with the further warrant of its being the only chance for life, yet we must not be carried away by the result of an exceptional case to expect anything like general success in similar cases; and, when we operate under such circumstances, the grounds on which we proceed should be clearly stated to the friends; and, from what I have said formerly, the surgeon must expect to meet with cases in which the child may die during the operation, or immediately on the trachea being opened.¹

CASES OF CROUP—Second Series.

1. The patient, D. R., $7\frac{1}{2}$ years of age, came home from school on the afternoon of the 21st January 1858, on account of a constant irritating cough, but he complained of no difficulty of breathing, nor any other urgent symptoms till about 8 P.M., on the 22d, when the dyspnoea rather suddenly supervened, and increased so rapidly that a medical man was summoned, and found him so ill that he recommended me to be sent for to perform tracheotomy. When I saw him, about half-past 10, he appeared moribund, breathing only at long intervals, the chest not expanding, the pulse scarcely to be felt. Having explained the probability of the child dying during the operation in such circumstances, the parents still expressed their desire that the chance might be afforded him. I accordingly performed the operation, and on inserting the tube some mucus was ejected. By keeping up artificial respiration, administering enemata of port wine, and applying sinapisms to the abdomen, the respiration and circulation gradually became restored and regular, but the pupils remained dilated, insensible to light, and the child was quite unconscious. In about two hours after the operation he became sensible, expressed relief, breathed easily, and had some sleep, and in the morning I was equally surprised and gratified to find him in a state which promised every hope of success. At noon I changed the tube, and replaced it by a double one, so as to ensure it being kept thoroughly clean. He had a dose of grey powder, and small doses of antimonial wine were ordered to be given at intervals. In the afternoon, however, the breathing again became difficult, although the tube was quite clean; and at 10 at night I found him tossing about, with

¹ These remarks on the foregoing cases of tracheotomy in croup were published in 1858, and I have reprinted them here to show what my original views were, and that my present opinions, and my advocacy of this operation, are the results of my previous views having been gradually modified by experience.

great dyspnoea and rapid pulse. The tube was again withdrawn and examined, and found free from obstruction, and replaced by another, but without any relief. I bled him to the amount of 3 ounces, with temporary relief to the urgent dyspnoea and violent action of the heart, but he soon relapsed into the same state, became insensible, and died about midnight.

On examining the body, the larynx, and a considerable extent of the trachea, were found to be lined by a tubular effusion of false membrane, the lower portion of which had passed farther down than the incision in the trachea, but had been pushed aside by the tube when introduced. Patches of lymph were found at the commencement of both bronchi, whilst the smaller subdivisions of the bronchial tubes were at many points quite blocked up by little masses of exudation. There was no great amount of mucous effusion in the bronchi, but the substance of both lungs was much congested. (See plate XXXIV., fig. 2.)

2. Margaret B., *æt.* 7½, after playing on Leith Links on a cold wet day, was seized on the 26th of March with a severe, rough, and hard cough. On the 1st of April Dr. Williamson found her labouring under acute croup. Although the symptoms were very urgent, yet, on consultation, it was determined to delay operating till other remedies were tried. Next morning the symptoms were so intensely aggravated that I was sent for to operate. On my arrival the dyspnoea was great, pulse weak and intermittent, and the surface cold. Stethoscopic examination showed the presence of mucous râles in both lungs, and this, with the exhausted state of the child, induced me to consider it an unfavourable case for tracheotomy. The operation was performed, however, partly to relieve impending suffocation, and partly at the earnest desire of the parents. On opening the trachea some mucus was ejected, and the relief to the dyspnoea was immediate. From this time the child progressed most favourably, the mucus being readily expectorated through the tube, which was retained for upwards of six days.

3. Louisa Paton, *æt.* 5, was attacked with croup on the evening of the 15th April 1858. The medical attendant, who saw her on the 16th, administered the usual remedies without effect; and as the disease was progressing rapidly, she was removed to the Infirmary on the 18th, and the same evening tracheotomy was performed by Mr. Spence. The immediate relief was great. She continued better all next day, but again became worse, and died on the morning of the 21st, about fifty-one hours after the operation, and the sixth day of the disease.

4. Marion Henderson, *æt.* 4, had a regular attack of measles in the last week of July 1858. On the 29th there was considerable cough and dyspnoea, the latter of which was much more urgent on the 31st, and next day was so great as to necessitate tracheotomy. There was much relief at the time, but she soon relapsed, and died on the morning of the 2d August.

5. George Nash, *æt.* 2, caught cold on July 4th, 1858. Next day symptoms of croup supervened, and on the 7th a suffocative spasm necessitated his removal to the Infirmary. Emetics and sinapisms proving useless, and the paroxysms having recurred several times, Mr. Spence that same evening opened the trachea. The child continued restless till 4 A.M., after which he slept for nearly two hours. Next day the breathing was somewhat more laboured, but after the application of a sinapism between the shoulders it became easy and the pulse natural. On the 11th the tube was removed for a short time, but required to be replaced owing to the large amount of tough mucus clogging up the trachea, and which could only be expelled through the tube. Two days after the tube was finally removed; and on the 4th of

August he was dismissed, the wound in the trachea having been healed for some time previously.

6. F. S., *æt.* 6, was first visited by Dr. James A. Sidey on the 5th of November. He had been suffering for five days from feverishness and sore throat, and on the previous evening had shown symptoms of croup. When seen his tongue was foul, tonsils ulcerated, breathing difficult and croupy, and pulse 140. Leeches and emetics failed to give relief; and next day, his breathing having become more gaspy, I was sent for, and performed tracheotomy. I extracted some false membrane during the operation, and after it the child coughed up some moulds of the bronchi. He continued well during the whole of the next day, but on the 8th began to get worse, and died November 9th, 1858.

About a week or ten days after, his two sisters were affected with undeniable scarlet fever, and his mother with ulcerated sore throat.

7. W. R., *æt.* 4½ years, after sitting out in the garden, towards evening, on the damp grass, began to suffer from a severe cold. Five days after, on the 29th of March 1859, Dr. William Ziegler was sent for. There were signs of slight bronchitis in both lungs; the cough was hard, ringing, and croupy; the inspirations were free from stridor; he was dull and listless, and had lost considerably in flesh, but there was no febrile excitement, nor pain on pressure over the larynx. He was ordered an ipecacuan emetic, to inhale steam, fomentations over the larynx, and a sinapism to the chest. On the 30th the cough was not so hard, but the bronchitic râles were more general over the posterior lobes of the lungs; there was slight mucous expectoration; the skin was hotter and the pulse quickened. A blister was applied to his back, and he was ordered a mixture containing antimonial wine; the ipecacuan emetic to be repeated if the breathing became oppressed.

On the 31st he was rather worse, his breathing having been much oppressed during the night. He was restless, his pulse rapid and weak, skin hot, face flushed, cough more frequent and decidedly croupy, inspiration husky and laryngeal. There was, however, no lividity. The ipecacuan having failed to induce vomiting, sulphate of copper was given instead. Small quantities of white wine were administered, and the inhalations and fomentations continued. During the day the sulphate of copper was given several times, and each time induced severe vomiting, but without producing any favourable change. Mr. Spence was therefore called in consultation; and on April 1st, at 4 A.M., it was found necessary to perform tracheotomy. Considerable relief followed the operation, and the child's progress to recovery was rapid. The tube was removed on the fifth day, and it was not again found necessary to return it.

8. — O., *æt.* 4½ years. After the child had suffered from croup for twenty-four hours, during which time all the ordinary remedies had been unsuccessfully employed, Mr. Spence performed tracheotomy. This was followed by immediate relief, even although the chest did not expand very fully. The child went on improving for the next twenty-four hours, when, on the return of the dyspnoea, the tube was removed and a larger one introduced. This was again followed by great improvement, continuing for the next five hours. He then became restless; a considerable difficulty of inspiration commenced; expiration remaining so free that he blew out a lighted taper placed before the mouth of the tube. This attack lasted about half-an-hour, when he died.

Examination, thirty-six hours after death, showed great emphysema of both lungs, some congestion, but no pneumonia. The croupous membrane

was confined to the larynx, but the trachea and bronchi were lined and partially blocked up with very tenacious mucus. The right side of the heart was distended with dark blood.

TRACHEOTOMY IN DIPHTHERITIC CROUP.

1. Ann A., æt. 2½, admitted December 4, suffering from diphtheria with severe laryngeal symptoms. She had been ailing about a week, but the dyspnoea only became urgent the day previous to admission. As the paroxysms were frequent, and the breathing greatly impeded, the trachea was opened. Immediately after the operation the patient fell into a quiet sleep. She went on most favourably; the tube was removed on the fifth day, and she breathed freely through the wound. On the eighth day the wound became dry and grey; on the tenth a slough separated. The constitutional symptoms accompanying this attack of sloughing phagedæna were of a very low type. She died on the eleventh day. The local treatment consisted of the application of strong nitric acid, with chloride of soda, and very weak Condy's solution. Stimulants and nourishing food were given, both by the mouth and rectum.

2. John C., æt. 3; admitted 5th January, labouring under diphtheritic croup, accompanied with extreme dyspnoea. Tracheotomy. Dismissed 30th January. Cured.

3. Alex. F., æt. 3; admitted June 1st, suffering from extreme dyspnoea. Diphtheria. Tracheotomy. After the operation he had repeated attacks of convulsions, with squinting. Dismissed 30th June. Cured.

4. J. B., æt. 4½; admitted 12th June, with great dyspnoea. The whole of the fauces covered with false membrane bled when touched. Tracheotomy. This patient went on most favourably until the 20th. Symptoms of paralysis of the pharynx and glottis occurred. She was fed by the stomach-pump twice daily, and by enemata. The prostration, however, increased, and she died on the 26th June.

Remarks:—In A. F., the false membrane formed below the tracheal opening, and led to such serious dyspnoea that the tube had to be withdrawn, and the trachea cleared of the deposit as thoroughly as possible. The patient was a very stout, healthy child, and was able after the second day to cough up the membrane through the tube. He was repeatedly placed in a hot bath, on account of several attacks of spasmodic dyspnoea; great relief was experienced, and he slept quietly for hours afterwards. As a certain amount of thickening continued in the air-passages beyond the usual period, the tube could not be completely dispensed with until the beginning of the third week. John C. was likewise a stout healthy child; he had not a single unfavourable symptom after the operation. The condition of the wound in Ann A., which is termed in the report "sloughing phagedæna," larger experience has shown me to be really diphtheritic.

FOREIGN BODY ENTANGLED IN THE PHARYNX.

Case in which a double fish-hook, entangled in the pharynx, was extracted by means of a special apparatus devised by the late Mr. Gillespie, Surgeon to the Edinburgh Royal Infirmary.¹

¹ I am indebted to my friend Dr. James Gillespie for this case, from his father's notes in the Journal of the Hospital.

John Paton, æt. 14, admitted into the Infirmary *August 26th*, 1819.—Two evenings ago, while in the act of making an alteration in a fish-hook by putting it between his teeth, his attention was suddenly drawn to another object, and he unwarily swallowed the hook.

On examination, the upper part of a double pike-hook can be distinctly seen at a short distance beneath the epiglottis, situated in such a manner that the barbs of the hook appeared to be fixed into the posterior part of the pharynx.

The wire which is attached to the hook passes through the mouth, and the extremity projects fully two inches beyond the lips.

The pharynx and velum pendulum palati are somewhat inflamed; the voice is rather hoarse; and speaking seems to give him considerable uneasiness.

He experiences so much pain in attempting to swallow that he has abstained from food since the accident.

The countenance is expressive of anxiety, pulse natural, tongue clean, bowels open, sleep rather disturbed.

A variety of means have been used to extract the hook, but without success.

29th.—Has continued free from any unpleasant symptom, and has swallowed bread soaked in beef-tea without much uneasiness.

This morning the pain has rather increased, and he has therefore desisted from taking any more food. The redness of the fauces is still present, and the voice continues altered.

Pulse natural, expression of countenance the same, tongue clean, bowels open. Had a tolerable night.

30th.—After a consultation of the surgeons, it was determined that no severe measures should be used, as there were no symptoms present indicative of immediate danger. The boy continues nearly in the same state.

One of the barbs of the hook was detached by Mr. Gillespie, who passed his finger along the wire, and pushed the shank of the hook downwards.

To have as much calves'-foot jelly as he can take.

September 3d.—The hook was this day extracted by means of a probang, with an ivory ball at its extremity.

In shape and size the ball resembled a pigeon's egg, and was perforated lengthways by a hole large enough to admit the shank of the hook.

The wire was put through the opening above described, and the ball, passing along, was pushed down till it came to the curve of the hook, its shank having been received by the perforation in the ball.

It must now be observed that the barbs of the hook were detached from the pharynx by pushing the ball downwards, and were prevented from again catching by drawing the hook upwards, and thereby bringing its barbs in close contact with the ivory ball.

The boy suffered no pain or uneasiness afterwards, and was dismissed cured in September 1819.

LECTURE XCVIII.

INJURIES AND DISEASES OF THE THORAX: Superficial and Deep-seated—Diseases of the Clavicle—Excision of Clavicle—Excision of Scapula—Diseases of the Mammæ: Abscess; Hypertrophy: Tumour—Excision of Mamma.

FRACTURE OF THE RIBS: Diagnosis; Treatment—Emphysema—Wounds of Thorax: method of examining them; Dangers and Complications attending them—Pneumothorax, Hæmatothorax, Hydrothorax, and Emphysema: their Symptoms; Treatment.

PASSING from the cervical region, I now proceed to consider the INJURIES AND SURGICAL DISEASES OF THE THORAX, and the operations required for their relief.

This region, for the purpose of distinction, may be divided into the superficial pectoral, and deep or proper thoracic regions. In the former I must also include the axillary space situated between the thorax and upper extremity. In the superficial region we meet with a great variety of morbid growths requiring surgical operations for their removal. In the case of axillary tumours, their relation to the important vascular and nervous structures contained in that space renders it necessary that the surgeon be exceedingly careful in his diagnosis and in his operative proceedings, almost as much so as in the case of deep cervical growths. I have had occasion to remove the whole of the great pectoral muscle from its thoracic and clavicular attachments to its insertion into the humerus, on account of a medullary sarcomatous tumour developed in its structure. The coraco-clavicular aponeurosis was almost destroyed by pressure of the growth, and the axillary vessels and nerves were fully exposed during the dissection. In another case I removed an enormous malignant cystic tumour occupying the axillary cavity, and pushing aside the scapula behind and the pectoral muscles in front. I need hardly say the dissections in such cases are attended with great danger, and must be carefully and quietly proceeded with; and in the axilla the loose connections of the cellular tissue should be separated with the finger, and the knife used sparingly after the first incision, which should be very free, so as to divide the axillary fascia and expose fully the surface of the growth. Smaller firm tumours under the pectoral muscles can be readily removed. In other cases the great pectoral muscle requires to be freely divided, to expose fully the parts involved in the operation. Here, as in the case of deep cervical growths, no special rules can be given; each case must be studied, and the anatomical knowledge and skill of the surgeon must guide him in planning and executing the operation.

EXCISION OF THE CLAVICLE may be required for tumour or other diseased condition of the bone. If the tumour be malignant, or of doubtful character, the whole bone should be removed. In other cases the external or internal half of the clavicle may be excised. Removal of the entire bone is perhaps the easier operation, for, by disarticulating it at its junction with the acromion, we obtain a longer lever to draw it away from the vessels, and by keeping the edge of the bistoury towards the bone the vessels run less risk of injury. In a case in which I required to excise the internal half of the clavicle, the bone had given way about an inch and a half from its acromial extremity, and from condensation of surrounding structures I found it very difficult to get the bone drawn forwards, even with a pair of strong tooth-forceps. In that case the bone was very irregular on its deep surface; and, on its removal, the motion of the subclavian artery could be seen, the vessels being only covered by a thin layer of cellular tissue. The disarticulation of the sterno-clavicular joint has been generally regarded as the greatest danger in the operation; and no doubt the close proximity of the innominate vein and great arteries at the root of the neck requires that the surgeon should proceed very warily at the moment of disarticulating. At the same time I scarcely think the risk is so great at this part of the operation as in clearing the posterior surface of the clavicle, where it lies in relation to the subclavian artery and vein. At the sternal articulation, the sterno-hyoid and thyroid muscles, and their fascial covering intervene between the joint and the vessels; and if the rhomboid ligament connecting the clavicle with the rib be thoroughly divided, and the articulation opened in front, we can twist round the articular end of the bone, so that, by keeping the edge of the knife cutting upon it, the remaining texture can be divided without much risk. Or we may complete the disarticulation with a probe-pointed knife, if that be thought necessary.

Keeping in mind these details, the general method of performing the *Operation* is as follows:—An incision is made upon the clavicle along its whole length, if the entire bone is to be removed; or, in cases of partial removal, to beyond the point where the section of the bone is proposed. At each end of this incision two short perpendicular incisions are made, and the attachments of the sterno-mastoid and trapezius muscles, superiorly, and those of the pectoral and deltoid inferiorly, together with the other soft parts, are dissected from the clavicle. In the case of excision of the entire bone, its acromial articulation is opened, and the clavicular attachments of the conoid and trapezoid ligaments divided. Then, by means of a pair of strong tooth-forceps, or the lion forceps, the acromial end of the bone is elevated, so as to allow the subclavian muscles and other deeper attachments of the bone to be safely divided. In this stage of the operation the operator should keep the edge of his knife directed towards the lower surface of the clavicle, so as to cut the textures upon the bone, and avoid risk to the subclavian and supra-scapular vessels, which are in close proximity. As the textures are divided the clavicle is gradually drawn more forwards, away from the chest as it were, still further to secure the safety of the vessels. The costo-clavicular ligament, at the sternal end of the

bone, must be thoroughly divided, and the sterno-clavicular articulation freely opened in front; then, by using the new loosened clavicle as a lever, its sternal articular extremity can be twisted round so as to divide the remaining ligamentous attachments, and complete its disarticulation without risk to the great vessels at the root of the neck. The difficulty and danger of the operation cannot be estimated by operating on the dead body; the irregular form of the diseased bone, or the bulk and shape of the tumour, or condensation of surrounding textures in the diseased state, being the chief sources of difficulty in performing the operation on the living. (See Clinical Cases.)

EXCISION OF THE SCAPULA may be required on account of fibro-cartilaginous, or medullary sarcomatous tumours of the bone. I have already spoken of removal of the scapula along with the arm, but excision of the bone, leaving the upper extremity, is a more difficult, and in some respects, a more serious operation. The incisions of the integuments may require to be varied in different cases. In one case, when I had removed a large medullary cystic tumour from the axilla, I found the subscapular fossa affected by a similar growth, although the posterior aspect of the bone presented no appearance of disease. In that case, having already made a free incision in the axillary space, I made an incision from over the acromial end of the clavicle backwards along the spine of the scapula to beyond its base, and dissected back the large flap so marked out. I then divided the attachments of the trapezius, deltoid, rhomboid, and levator angulæ scapulæ muscles, and cut through the clavicle near its acromial end. The scapula was then drawn backwards and outwards, disarticulated at the shoulder-joint, and the operation completed by dividing the serratus magnus. Under ordinary circumstances I would, after making the incisions through the skin, begin by dividing the clavicle a little internal to the attachment of the coraco-clavicular ligament, so as to enable an assistant to command the circulation, and so prevent the gush of blood which follows division of the subscapular artery. As to the lines of incision, I have said they must be varied in different cases; but, in general, the best method is to make one long incision from over the external third of the clavicle, backwards and downwards crossing the spine of the scapula obliquely, to beyond its inferior angle. Another incision should be carried downwards and forwards from the superior and posterior angle towards the neck of the scapula, behind the glenoid cavity, or beyond the lowest part of the tumour. Then the flaps so marked out are dissected back, the clavicle divided internal to the coraco-clavicular ligament, the scapular attachments of the deltoid and trapezius divided, and the humerus disarticulated. The great vessels being now commanded, the remaining muscular attachments of the scapula to the trunk are divided, and the operation completed. After all bleeding is arrested, the incisions are united by silver sutures, and the elbow supported by a handkerchief, a flat pad placed in the axilla, and the arm bandaged to the side.

This was the method I adopted in the successful case of J. D., reported in the Clinical Cases.

In my remarks on that case it will be seen that there was considerable difficulty in managing the head of the humerus during the after-treatment, and that, in consequence, I propose that section of the clavicle should be avoided; but whilst I believe the broad acromial end of the clavicle would be useful as a point d'appui for the head of the humerus, I think that the difficulty I met with in D.'s case might also be now easily obviated by the use of continuous extension with weight and pulley.

There is, perhaps, no organ more frequently the subject of surgical treatment than the female breast. As the result of lactation, or other causes of irritation, ACUTE AND CHRONIC MAMMARY ABSCESES arise in or beneath the breast, and require to be opened early and freely to prevent the formation of troublesome sinuses. The incisions made to evacuate the pus in such cases should be free; nothing can be more cruel than to make a small puncture or inadequate opening, squeezing out the pus, and then requiring to enlarge the opening, or make other incisions to give free vent to the matter. When the abscess is near the nipple the incision should be made obliquely and parallel to the nipple ducts, so as to avoid cutting any of them across. In some instances the purulent collection is situated under the gland; in such cases the collection should be compressed so as to make it project towards the lower border of the breast, if possible, and an incision made into it along the lower margin of the gland, and a drainage-tube inserted. By this means the matter gets easier exit, and the mamma is not interfered with.

The mammary gland is also liable to HYPERTROPHY, and when discutient remedies fail this may require an operation for its removal; but, unless the distress caused by the bulk be very great, an operation should not be urged.

IRRITABLE MAMMA is another condition in which the surgeon is not unfrequently urged by patients to excise the gland; but it is purely a neuralgic affection, and the pain is almost certain to return in the cicatrix if the operation be performed, and hence our treatment should be constitutional rather than local.

MAMMARY TUMOURS.—The female breast is a very common site of the different forms of tumour growth, simple or malignant. Of the simple class—the adenoid or chronic mammary tumour, the fibrous, fibro-cystic, and cystic, are those most frequently met with in this region; the adipose or fatty tumour is, so far as my experience goes, exceedingly rare. Amongst the malignant tumours carcinoma, and the various forms of medullary and fibro-plastic sarcoma are, unfortunately, of very frequent occurrence in the breast; and too often, owing to ignorance or a false delicacy, the surgeon is not consulted until too late.

When lecturing on tumours I have indicated the principles on which we should proceed in dealing with the different forms of tumour in this and other organs, and I pointed out that in doubtful tumours of the breast, where there is a want of distinct definition, or when the

patient is of such an age that the function of the gland has ceased, complete removal of the whole breast is the proper method of procedure. In the male we also occasionally meet with tumours of the breast requiring removal by operation.

The usual method of performing EXCISION OF THE MAMMA is by means of an elliptical incision, placed nearly parallel to the fibres of the great pectoral muscle. The patient being placed recumbent, the arm is separated from the side to render the pectoral muscle tense. The operator, holding the breast upwards so as to stretch the skin, first makes the lower incision at some little distance below the nipple, then draws down the breast and makes the upper incision above the nipple so as to complete the ellipse. Care should be taken to preserve sufficient healthy skin to cover in the wound. The integuments are next dissected off the tumour. The dissection is then carried deeply through the fascia covering the pectoral muscle, and that fascia, together with the tumour, dissected from off the muscular fibres. Should the tumour implicate the muscular fibres, they must also be removed. If any axillary glands are affected, the lower incision is carried outwards and upwards, the axillary fascia opened, and the gland seized with a vulsellum, carefully dissected or twisted out with the finger. The bleeding vessels are tied or twisted, and when this has been effected, the surfaces both of the tumour and wound should be carefully examined before closing the wound, to make sure that no portion of diseased texture is left. The surface of the wound is cleansed by pouring tepid boracic lotion freely over it, and then the margins of the incision are approximated and retained by silver sutures. I generally insert three or four sutures very deeply, and at some distance from the free margins, and other intermediate points of suture between these, to unite the margins very exactly. A broad fold of lint soaked in boracic lotion and covered with waxed paper is laid flatly over the incision, and supported by a broad bandage. Afterwards boracic water dressing should be applied to the wound, which generally heals throughout its superficial extent at least. In my own practice I usually leave the axillary end of the incision open, and insert a piece of drainage tube to allow the serous or bloody discharges to escape, and so prevent the formation of abscesses subsequently.

In many cases, owing to the form of the tumour to be removed, we may require to make our incisions in a different direction. Incisions directed from above downwards and outwards answer very well. Sometimes crucial or T incisions may be required, but a straight incision from above downwards should be avoided. After excision of the breast the arm should be kept close to the side, and all motion prevented.

I shall now direct your attention to the subject of INJURIES OF THE CHEST and their results—and first to FRACTURES OF THE RIBS. The ribs may be broken at any point, but generally they give way about the angle, or a little in front of it. In old people, where the cartilages are ossified, we sometimes find the ribs broken at the junc-

tion between the bone and the cartilage; and in very young children, where the union is not quite complete, separation occurs at the same place. These injuries generally arise from direct violence. The patient complains of pain in breathing, and on attempting to cough. There is seldom any projection at the fractured point, unless the fracture be a very severe one, and hence we require to take some care in forming our diagnosis. The best method is to ascertain exactly where the pain is referred to, and this will guide us generally to a point at or near the fracture. Then, by moving the corresponding rib, we feel for crepitus, which can usually be detected easily, or we may place the hand over the suspected part and make the patient take a deep inspiration, so as to expand the chest, and thereby produce crepitus. A fracture near the angle of the rib is said to be more difficult of detection, but I think it is not so, for if we move the injured rib by pressure anteriorly, we can elicit crepitus at the site of fracture very easily. Sometimes the fracture may be indicated by another symptom. There may be scarcely any displacement, but we may find some emphysema present. This could only occur from a portion of the rib injuring the pleura and the lung, and causing the air to escape from it into the loose cellular tissue around the fracture. If emphysema be present after an injury of the chest where there is no external wound, even though we cannot detect crepitus, we may be pretty sure that there is a fracture of one or more ribs. The presence of emphysema cannot be accounted for in any other way, unless there be an external wound.

When several ribs are broken, the diagnosis is very easy, but the injury is a serious one, and the prognosis bad. I, however, recollect one case in which the sternum was broken across, the cartilages thrown forwards, and several ribs fractured, in consequence of a railway accident. This injury was accompanied with effusion of blood internally, and some emphysema. The patient's pulse was very weak, and at first his case seemed hopeless, but ultimately he made a good recovery, and retained no trace of the injury save some slight deformity of the chest.

In cases where we have any doubt as to the diagnosis we judge from the history. If a person receives a blow on the side, and complains of great pain on breathing, the safest plan is to assume that a fracture is present, though we may not be able to feel crepitus. We should keep in mind that there is risk of injury to the pleura or thoracic viscera by manipulating much to obtain that diagnostic evidence.

The best *Treatment* either for a bruise on the chest or for a fractured rib is to put a broad bandage round the chest to control the movements of the ribs. Sometimes a broad cotton roller is put round the chest several times; but it is better to use a very broad flannel bandage, and pin it firmly, for we do not want to interfere with the breathing, but merely to confine the respiratory movements within certain limits, and to support the broken bone. If we use an ordinary roller we are apt to press too firmly on one portion of the rib, and so do more harm than good. When several ribs are fractured the same treatment is required, but the bandage must be applied more firmly. Along with this local treatment we should give opiates, aconite, or digitalis, to allay the cough and irritation, but not antimony or ipecacuanha,

as they are apt to cause vomiting. If there be great pain in the chest, venesection should be had recourse to; for if there be much congestion, especially in healthy patients, a moderate amount of depletion will relieve it, and really with less loss of vital power to the patient than would accrue from a long course of depressing remedies internally.

Fracture of the ribs, as well as some other injuries of the chest, may give rise to the condition known as EMPHYSEMA. Two or three ribs are broken, for example, and comminuted, without any external wound being present. A portion of a rib is projected inwards, tears the pleura, and wounds the surface of the lung: the air-vessels are opened into, and the air escapes. If the wound in the lung be considerable, the air escapes pretty rapidly. It passes into the pleura very readily, then into the intercostal spaces, and thence is diffused into the subcutaneous cellular tissue over the chest. There is air over the surface of the fracture—it extends into the axilla, and passes up around the pectoral muscle into the neck. The neck, face, and axilla become distended, also the front of the abdomen, the sides, the back, the scrotum, and the lower extremity; in fact, the external surface of the subcutaneous cellular tissue is blown up by the air which escapes. This does not happen often to the full extent I have stated, but the accompanying sketch is not altogether a fanciful case.¹ I recollect the case of a child, about five or six years old, who got several ribs broken: the whole body became much swollen—the face was enormously distended, and also the neck, chest, scrotum, and extremities. Percussion gave a tympanitic resonance, as if a drum had been struck.

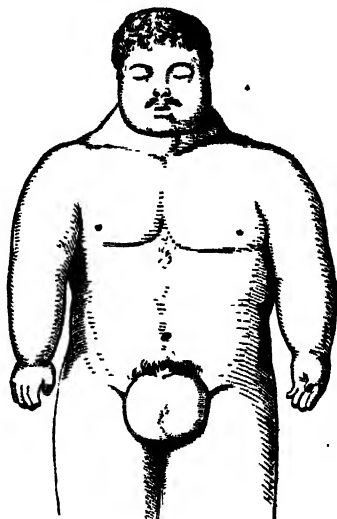


Fig. 193.

(See Clinical Cases.) Such a case is an extreme one, but the same condition may occur more slowly, and to a less extent, giving rise to serious danger. The same principles of treatment are required in either case. It is sometimes recommended, in incipient stages of emphysema, to bandage the patient so as to prevent the air from spreading all over the body; but if the air does not get to the cellular tissue it accumulates in the pleura, and the more dangerous condition of pneumothorax will occur. It is therefore better to allow the cellular tissue to get distended, than to run the risk of letting the air collect in the pleura.

The *Treatment* of emphysema, when there is no external wound, is to refrain from bandaging at first. We always have more or less pneumothorax present, and the lung is partially collapsed. But such collapse is rather beneficial, for it allows the injured lung to rest; the circulation through it is diminished; the wound, if small, is glazed

¹ Fig. 193 (Larrey's case of the *Light Dragon*).

over by plastic exudation, and the further escape of air or blood is prevented. In cases of slight emphysema, little or no treatment is necessary beyond that required for the fractured rib.

In other cases, when the emphysema is extending, and where respiration is affected, we make numerous small incisions through the skin wherever the air is collected in the cellular tissue. These are made over the whole body, and through them the air escapes very readily. The tension, pressure, and difficulty of breathing, become less, and the air in the pleura also becomes diminished, for it escapes less directly and gradually as the air in the cellular tissue passes through the incisions. Hence, in all cases, I recommend making small incisions or punctures in different parts of the body, wherever the air is infiltrated, so as to let the air in the cellular tissue escape.

If a person receives a STAB or WOUND OF THE THORAX which does not implicate the lung, if that organ is expanded in the act of inspiration it does not collapse. Indeed, it being inflated, often projects, so as to form a hernia of the lung. In such cases, the air entering by the air-passages into the distended lung counteracts the force of the air entering the pleural cavity by the wound. If, however, we have a wound inflicted during the act of expiration, or if the wound penetrates the lung, then we can easily understand how collapse will take place; because, in the former case, the air enters the chest as the lung is contracting, and in the latter the air entering by the mouth escapes by the wound of the lung into the pleura, while the air entering by the external opening rushes into the pleura at the same time, thus causing almost complete collapse of the lung.

A certain amount of bleeding takes place in these injuries, and if we close the wound, as is sometimes recommended to be done, the lower part of the cavity of the chest becomes distended. This causes difficulty of breathing. The upper part of the chest has a resonant tympanitic sound on percussion, and the lower part a dull sound, for the blood from the wound falls towards the lower and back part of the chest, where it collects, and presses down the diaphragm to some extent. In the upper part of the chest the air which has escaped from the air-vessels is collected. If we see a case of wound of the chest immediately after the injury is received, then, if there be no wound of the lung-substance, it will be advantageous to close the wound at once, but when the lung itself is also injured, the proper plan of treatment is to leave the wound open, so as to allow the escape of the blood, as it is impossible entirely to control hæmorrhage, and also to allow the air to escape, and so let the lung collapse. The circulation in the lung is thus diminished or interrupted, and the hæmorrhage from the wound in its substance is thereby arrested; we give time for the parts to glaze over, and for the air-vessels to close up by the effusion of lymph. The bloodvessels become closed, while the lung is collapsed, and then after thirty hours or so, if there be no contra-indication, we may close the external wound. The lung will, in all probability, gradually distend again; but even if it does not, there will be no interruption to the action of the opposite lung, and no displacement of the heart and

bloodvessels. This, I think, is the proper treatment, the principle of it being to give time for the parts to be glazed over before closing up the wound. Subsequently, if air or fluid collects in the cavity, paracentesis or aspiration may be had recourse to.

I generally lay the patient on the wounded side; this allows the discharges to escape, and then the parts are so placed that the air can pass out, though more air cannot readily get in. I also place a thin slip of oiled muslin over the opening, arranged as a valve, to allow the escape of discharge, but prevent the entrance of air. At the same time some support should be given to the chest by a bandage. The general treatment must also be attended to, as there is a risk of pleuritis coming on, and opiates should be given to allay the pain and irritation. When much blood has been lost, support the patient's strength, but unless the prostration be urgent do not give diffusible stimulants, which are apt to excite irritation and inflammation in the parts.

The method of examining wounds of the chest and abdomen is important; for there is sometimes much mischief caused by not attending properly to this point. As the great danger lies in the fact of the wound being a penetrating one, the risks are very much increased if, as often happens, the surgeon is too anxious to make out clearly at the very first whether the wound be penetrating or not. In many cases there can be very little doubt, from the markedly sunk and depressed appearance of the patient, the irregularity of the pulse, and the state of the respiration. If the lung be wounded there will be more or less bloody sputum, though this may not appear at first if only the extreme ramifications of the bronchi be wounded; but as the cough becomes more frequent, instead of the rusty sputum of pneumonia, there is bloody sputum. The wound may not be a penetrating one; but if the surgeon be over-anxious to make a correct diagnosis, and use the probe freely in a wound of this kind, where the parts closing the cavity are naturally thin, and where the wound may have penetrated all but through the pleura costalis, he will probably convert it into a penetrating wound. Hence I think that in such cases it is better to wait a little and take the indications of the symptoms as to the character of the injury.

If the wound be a penetrating one, with any lesion of the viscera, the symptoms will soon be very marked, and will leave us in no doubt as to its nature and the danger attending it. If it be a very slightly penetrating wound, and if the bad symptoms do not come on, the patient is all the better for not having it probed and interfered with. In most cases we find that in penetrating wounds of any importance, unmistakable evidence soon appears as to their character, and therefore we may rest satisfied without being too anxious to examine and ascertain their depth at first. We may examine the weapon which inflicted the wound, to gain some idea of the depth, but not the wound itself, for that involves risk to the patient. So also in fracture of the ribs, we examine them as already described, but do not manipulate and poke about the chest, for by pressing in on the fractured rib we may thrust the broken ends through the pleura, and do much more harm than good. If we are in any doubt, it is better to treat the case as if it

were one of simple fracture of the rib. When an accurate diagnosis is necessary in reference to the treatment, or when our examination is attended with no risk, we ought to be most exact in our diagnosis; but where the knowledge whether it is a penetrating wound or not makes no difference in the treatment of the case, we should not incur risk to make out the nature of the injury. The treatment in every case ought at first to be the same as if the wound were a penetrating one. Use all precautions to keep the patient at rest, give opiates and deplete if necessary, to allay the irritation and pain which are present.

As a result of injuries of the chest, dangerous conditions may arise from embarrassment of the functions of respiration and circulation. Besides the acute inflammatory affections of the pleura and lung-substance, the conditions which the surgeon is most frequently called on to treat are—Pneumothorax, Hæmatothorax, Hydrothorax, and Empyema. As these conditions though very different from each other pathologically, all act mechanically by compressing or displacing the thoracic viscera, they have certain symptoms in common which we shall first consider before speaking of these different conditions and their treatment. In all of them we have great oppression of the breathing, congestion of the face and neck at first, especially on the affected side, difficulty of lying on the sound side, weak and irregular pulse, and restlessness from threatened suffocation. These symptoms depend upon the pressure of the air or fluid within the pleura compressing the lung, and, as it accumulates, displacing to some extent the heart and great bloodvessels, interfering with the action of the diaphragm, and gradually affecting the action of the opposite lung when the patient tries to lie on the sound side. The correct diagnosis between the different pathological conditions is partly arrived at by physical examination, and partly by the history of the case and symptoms which may have preceded the formation of the collection. The distinction between pneumothorax and collections of denser fluids is easily enough made out by percussing the chest, the clear tympanitic sound leaves us in no doubt. But in regard to the other states mentioned, the effused fluid, of whatever kind it is, leads to dulness on percussion and the absence of respiratory sounds on that side of the chest, so that we must take into account the period after the injury at which the symptoms arise, and the presence or absence of premonitory fever and rigors. When the symptoms arise immediately or shortly after the injury, they are due either to pneumothorax or hæmatothorax, and percussion will determine which of these is present. Hydrothorax or empyema, again, are the secondary results of inflammatory action, and the general symptoms, especially the rigors and hectic, usually present in cases of empyema, will distinguish that from simple hydrothorax.

By the term PNEUMOTHORAX is meant the distension of the cavity of the pleura with air, and this may arise either from injury or from disease of the lung; but it is with the condition as it occurs from injury that we have at present to do. The escape of air from a wound of the lung into the pleura, or the entrance of air from without, occasionally follows penetrating wounds of the chest. But the cases in

which the pent-up air distends the cavity of the pleura, causing collapse of the lung, and oppressed respiration and circulation, are those of simple fracture of a rib, where a sharp point of the broken bone has punctured the pleura and lung-substance, and wounded some air-vessels. In such cases the small and possibly oblique wound of the pleura-costalis and intercostal textures does not permit the air to escape from the chest into the superficial cellular tissue, as in the case of extensive fracture, where we have emphysema with some pneumothorax. The air therefore escapes from the injured lung until it collapses, and accumulates in the shut sac of the pleura; and thus we have the interference with the circulation and respiration. The symptom which distinguishes it from hæmatothorax is the clear tympanitic sound on percussion. The respiratory murmur is lost, but the sound of the air entering the large bronchi at the root of the lung is preternaturally loud. The circulation is less speedily affected than in hæmatothorax, because here there is no loss of blood from the system, and also because the displacement of the heart and great bloodvessels is seldom so great as in the case of distension by effused blood or other fluids, such as serum or pus.

As regards *Treatment*, unless the general symptoms be very urgent it is well to wait a little before drawing off the confined air, so that the wound of the lung-substance may be closed by lymph or coagulated blood, which will serve to prevent the escape of air when the lung again distends on inspiration. The operation of extracting the confined air is effected by puncturing the thorax at the usual point of election, using for this purpose either the aspirator, Bowditch's apparatus, or a trocar and canula, with a stop-cock connected with an india-rubber bag, so as to obviate any air entering from without. As the air is drawn off, the patient is desired gradually to distend the lungs, and when all the air has been extracted the assistant is ready with a piece of oiled lint to place over the aperture as the surgeon withdraws the canula, then another fold of lint covered by gutta-percha tissue is placed over the part, and supported by a broad flannel bandage. I have already, when speaking of emphysema resulting from fractured ribs, stated what I considered the safest method of procedure for both relieving the emphysema and any pneumothorax which may be present in such cases.

Oppression of the lung, arising from effusion of blood into the cavity of the pleura, is termed HÆMATOTHORAX; it generally arises as a primary condition, either from a wound of the intercostal vessels or from a wound of the lung-substance. If we suspect that the bleeding is entirely due to a wound of some of the intercostal vessels, then the best treatment is to dilate the wound with a probe-pointed bistoury, feel for the bleeding point, and try to arrest it by tying the vessel. This is not easily done, even when the bleeding point can be felt. Where we cannot get the thread round the vessel it has been proposed we should introduce a dossil of lint within the cavity of the chest, and by means of a thread fastened to it, draw it outwards towards the ribs, so as to fix the lint against the wounded point and keep up the pressure; but the lint acts as a foreign body, and is apt to lead to serious

irritation, and may even cause pleuritis and suppuration in the cavity of the chest. In most cases, by passing an aneurism-needle so as to include the vessel on either side of the bleeding point, we can secure it by small silk or catgut ligatures.

The Treatment of hæmatothorax, arising from wound of the lung, has been already mentioned; any blood which has escaped should be removed by an exhausting syringe from the cavity of the chest, for if left it is apt to become decomposed and give rise to blood-poisoning.

As a result of inflammation from wounds, or after pleuritis, the surgeon may be called on to operate for removal of the serous or purulent fluid from the chest. This operation is termed *Paracentesis thoracis*, and is a very simple one when done for the removal of serous fluid, and it may be repeated without any danger. In most cases we find the pleura somewhat thickened, and it requires some little force to push the trocar through it, but there is no danger in the operation. The point of election is generally between the sixth and seventh ribs, about midway between the sternum and the angles of the ribs; when the chest is very much distended with fluid there is no great risk, for the fluid lies between us and the contained viscera. Guthrie, in his book *On Wounds of the Chest*, says that he has often punctured for fluid below the tenth rib, and to avoid the curve of the diaphragm, he punctured far back; but the objection to this is, that the fluid sometimes does not penetrate so far down, besides in every case the diaphragm rises up again and forms a sort of convexity towards the thorax, and we might puncture the diaphragm with the trocar in carrying it forwards; hence I think it is safer to puncture higher up—about the seventh rib. The trocar used is a very small one; it is pushed into one of the intercostal spaces, somewhat nearer the upper edge of the rib than the lower, for fear of wounding the intercostal artery—the trocar and cannula are pushed inwards, and then the fluid is withdrawn. A small exploring needle may be used; this allows the fluid to escape slowly. Air is occasionally apt to enter the wound. A method which I used formerly to employ was to put a piece of damp muslin over the orifice of the cannula; the fluid of course presses it outwards; but when the air attempts to enter the muslin is pressed inwards, so that no air can get in. A good trocar and cannula, fitted with a stop-cock and india-rubber tube, the end of which is placed under water, however, answer better. The exhausting syringe or aspirator may also be used, but great care is required in using them, for if the stop-cock be turned the wrong way the air enters very rapidly. These instruments answer very well for hydrothorax, but not for thick purulent collections in the chest. Percussion does not indicate the nature of the contained fluid, the sound being dull in all cases, whether serum, pus, or sero-purulent fluid be present; and we must therefore judge from the history of the case. If rigors and fever have preceded the formation of the fluid, or if it has followed a wound, we may be tolerably sure that we have to deal with empyema and not serous fluid. We may have the pus, as in all other chronic abscesses, more or less irregular, and varying in its consistence. Empyema is, in fact, just an abscess within the pleura. When the fluid is equable and tolerably thin, we can draw it off by a trocar and cannula,

as in hydrothorax, but sometimes we find that, after taking away some of the fluid, the instrument becomes choked ; a piece of lymph or curdy pus has entered the canula and plugged it up. Whenever we find that the pus is of an irregular consistence, with flakes of lymph in it, we should cut down upon the intercostal spaces and penetrate the chest by the old operation for empyema. This is not necessary in hydrothorax, or where the pus is thin, but only where the pus is thick and curdy. The incision through the intercostal spaces is made midway between the ribs, or rather nearer the upper margin of the lower rib than the lower margin of the upper rib. The skin is first drawn up and rendered tense, so that when it relaxes afterwards it forms a sort of valve over the wound. In other words, the wound of the surface is made so that it may not correspond to the deep wound. The surgeon then cuts down upon the intercostal muscles, and divides them till he sees the pleura, which generally bulges out ; the point of the knife is then entered into it, and some pus is ejected ; then with a probe-pointed bistoury the opening is enlarged, so as to allow the contained pus to escape freely. The lung is in most cases adherent, and cannot distend, though it tends to do so ; the air entering has still further a tendency to cause the lung to collapse. All the thick part of the pus can be drawn off in this way, much better than by the trocar and canula. When the surgeon uses the trocar and canula to draw off the fluid, and finds that he cannot draw it all off, he should leave in the canula, and use it as a sort of director, and enlarge the aperture by an incision on either side of the canula, and so give vent to the fluid, and then wash out the cavity of the pleura with a weak lotion of carbolic or boracic acid. When the operation is completed, the skin which has been drawn up falls down and closes over the wound, forming a sort of valvular covering. Then a compress of oiled lint, covered by gutta percha tissue, is placed over the wound, and supported by a broad flannel bandage.

CLINICAL CASES.

THORACIC REGION.



DISARTICULATION OF THE STERNAL HALF OF THE CLAVICLE.

G. L., labourer, forty-eight years of age, and of strumous habit, had suffered for a length of time from epileptic fits, consequent upon an injury of the head, received eleven years ago, by a fall from a height, and the whole of the sternal half of the clavicle was much enlarged and of irregular form. In the beginning of December 1847, he was seen by Mr. Falconer, Loanhead, on account of an abscess which had formed towards the outer part of the clavicle. This abscess was opened, and although the matter discharged was thin and unhealthy, no diseased bone could be detected by the probe. The wound healed in about a fortnight or three weeks. Shortly after it had cicatrised the patient fell down in one of his epileptic fits, and on recovering he found a thick but sharp-pointed portion of the clavicle projecting through the thin recent cicatrix. Mr. Falconer states that the projecting portion of bone was of diseased appearance when it first protruded; and when I saw it, about a week afterwards, in the beginning of January 1848, the exposed portion was rough, and apparently carious. After this, although the parts were kept in perfect rest, abscesses formed at various points near the clavicle, about the root of the neck, and in the supra-clavicular space in the vicinity of the subclavian vessels; also above the sternum. Near the sternum there was a small opening, through which the bone could be felt rough and bare; and the other abscesses, although the probe could not detect any direct communication with the diseased bone, evidently depended upon the irritation excited by its presence. I saw the patient two or three times after this, but the exposed portion of bone did not become loose; and it resisted every effort to detach and remove it.

After waiting for nearly three months in expectation of some necrosed portions becoming loosened by the natural process, but finding it still impossible to detach and extract it from the rest of the bone, whilst the man's health was rapidly sinking under the constant discharge and hectic, I proposed the removal of the whole internal half of the clavicle from its sternal articulation, so as to include all the diseased bone, to which proposal the patient at once assented.

On the 11th April 1848, I proceeded to excise the diseased portion of the clavicle, assisted by Messrs. Goodsir and Falconer, and in the presence of Dr. Smith, Messrs. Harvey and Edwards. Chloroform having been given, I made an incision about three and half inches along the inner half of the clavicle,

commencing about four lines internal to the sterno-clavicular articulation, and then made a perpendicular incision about an inch and a half in length across the former, at the point corresponding to the sterno-clavicular articulation. The clavicular attachments of the sterno-mastoid and pectoralis muscles were next divided. In doing this there was pretty smart hæmorrhage from numerous small vessels. I now divided the clavicle a little external to the exposed diseased portion, and tried to raise the divided extremity so as to pull it forwards from the great vessels. I found, however, that I could not effect this, owing apparently to some muscular attachments which had not been completely divided; these I divided fully, when I could see the bone thickened and irregular, owing to the deposition of new bone. I then dissected around this carefully; and Mr. Goodsir attempted to draw the bone forwards, by means of a pair of strong tooth-forceps, which I had brought on purpose, in case of difficulty. The dense and firm structures, however, prevented it being raised, so that I had to dissect the extremity of the bone cautiously, as the condensation extended as far inwards as the position of the great vessels. Whenever the mass of condensed tissue was wholly divided, the bone was raised and drawn outwards and forwards from the chest; then, by keeping the edge of the bistoury directed obliquely towards the clavicle, I divided the rhomboid or costo-clavicular ligament, and the other remaining attachments, and by using the free portion of the clavicle as a lever I was enabled to disarticulate it readily from the sternum. Although there had been smart bleeding during the performance of the operation, only three small vessels required ligature. The consolidation of the parts, and the diseased state of the skin, prevented the greater part of the edges of the wound being united by suture, and in the site of the removed bone there remained a very ugly-looking fossa, in which the pulsation of the great arteries could be seen and felt. This cavity was filled slightly with charpie, and supported by a bandage. After the patient was placed in bed, and had recovered from the effects of the chloroform, an opiate draught was exhibited.

I saw him again on the 15th of April, when he was suffering from an attack of bronchitis, to which he had been long subject. He had a constant harassing cough, but was expectorating freely. The impulse of the coughing was communicated strongly to the wound, which was suppurating freely, and healthy granulations were beginning to spring up. With the exception of the cough he was going on favourably. Warm-water dressing was applied to the wound, and he was allowed nourishing diet.

As the accounts I received from Mr. Falconer continued favourable, I did not visit him again till the 24th of April. The cough had then almost entirely left him, and he was sitting up with the arm in a sling; the wound was covered with granulations, and contracting rapidly. For a few days previous to my visit the red lotion had been applied to the wound. From this time I did not see him again till the 7th of May, when the wound had completely cicatrised. Little treatment beyond the occasional application of escharotics to the exuberant granulations had been required; his general health and appearance had much improved, and he now slept well at night, and was free from pain.

I saw him again in September; there was very little falling in of the shoulder of the side from which the clavicle had been removed. His general health continued good, and he had for some months been at his usual employment of a labourer.

Remarks.—The removal of the sternal half of the clavicle in this case was, I consider, sufficiently warranted by the state of the patient.

the constitutional irritation he was suffering, and the repeated formation of ill-conditioned abscesses at the root of the neck, and in dangerous proximity to the large vessels. Under these circumstances there was distinct indication for operative interference, either by removing the diseased portions of the clavicle, or by removing the whole sternal half of the bone at the articulation. I preferred the latter operation, for the following reasons: The diseased portion which presented itself was not loose or detached, and the probe introduced through the sinuses detected other altered portions nearer the sternum; so that the full extent of the disease could not be accurately ascertained; and as the character of the disease and state of the patient's general health forbade waiting for nature to throw off the dead portions, it appeared to me that the operation necessary for the removal of such diseased portions would be equally severe, and the effect less certain, whilst removal of the internal half of the clavicle would remove the whole disease; and as the continuity between it and the acromial end was already broken, union being maintained only by ligamentous tissue, the inner half was really of no use to the patient.

The difficulties which in this case rendered the operation more protracted than I expected from numerous trials on the dead body, were owing principally to the previous disease having caused great alteration in the parts around the bone; these were condensed, and their appearance, relations, and attachments altered close to the position of the sub-clavian vessels. The firmness of the new attachments prevented the clavicle being drawn forwards from these vessels, and rendered a cautious dissection necessary to free that portion of the bone, the altered and irregular form of which, from the deposition of new osseous matter, was also a cause of difficulty, as it prevented me keeping the edge of the bistoury close to its posterior surface. I conceive that stage of the operation the most dangerous; but when the posterior surface of the bone is smooth, or when, after separating the muscular attachments and dividing the clavicle with the saw, that bone can readily be drawn forwards and the edge of the knife kept close to the part to be removed, I should think the operation would be both more readily accomplished, and with much less risk.

As to the disarticulation at the sternum, that is effected without much difficulty, for when the incision of the integuments over the joint is free, and the rhomboid ligament attaching the clavicle to the rib wholly divided, the articulation is easily opened from above and anteriorly, and then, by using the bone as a lever, it can be twisted so as to divide the posterior part of the capsule, with scarcely any risk to the pleura or great veins; besides, the strong layer of the deep fascia, the origin of the sterno-hyoid and thyroid muscles, and generally a layer of fat, lie between the knife and these important parts; so that, if ordinary care be taken, they can scarcely be injured; and if further security were required, the use of a probe-pointed bistoury to divide the posterior part of the capsule would, I conceive, preclude any chance of accident in this part of the operation.

SUCCESSFUL CASE OF EXCISION OF THE SCAPULA

John Dow, aged 68, was first admitted to the Royal Infirmary under my care on the 25th of December 1871, on account of a tumour in the scapular region. He stated that the swelling had existed for upwards of twenty-three years, and that about twenty years ago he had consulted Mr Syne, who told him it might never trouble him, and as it gave him no pain he did not have it removed. He continued to work at his ordinary occupation as a saddler, without any pain or inconvenience, till about six months before his admission, when the tumour began to increase rapidly in bulk, and also became painful. At the time of his admission the growth was the size of a melon, somewhat flattened, and occupied the posterior aspect of the scapula in the infraspinous fossa. It was rather movable, but felt fixed near the neck of the scapula. He stated that with the exception of cough, and occasional attacks of rheu., his general health was good.

After he had been in hospital for some days he was attacked with shivering, severe tracheitic cough, and derangement of the digestive organs, which conditions culminated in an attack of erysipelas of the leg. I therefore advised him to leave the hospital for a time, and to return when his health was improved. He accordingly left on the 25th of January, and was again admitted on the 19th of February, 1872.

On admission he stated that the swelling had enlarged very much towards the axilla, and that the pain there and down the arm was so intense that for some nights past he had got no sleep. With the exception of the old cough his general health was now better, but the sudden increase of bulk and the pain made him desirous to have the tumour removed if all hazards.

On examination I found that whilst the part of the tumour in the infraspinous fossa of the scapula was still pretty movable, and not much altered in size or form there was a very marked enlargement towards the axilla, where it pressed firmly against the neck of the scapula and the shoulder joint, and nearly filled the axillary space. At the neck of the scapula the growth seemed fixed. I therefore gave it as my opinion that excision of the scapula would probably be required. As the patient was desirous that the operation should be performed as soon as possible I proceeded to operate on 21st February.

Operation—As the tumour had originally been of slow growth, and had remained seemingly movable up to a recent period, I thought it advisable, before proceeding to excise the whole scapula, to make my incisions so as to ascertain whether it was firmly attached to the bone or merely bound down by muscles and fascia. I accordingly began by making an incision from the posterior part of the acromion process obliquely downwards and backwards over the tumour to beyond the inferior angle of the scapula, dividing freely the fascia and fibres of the infraspinatus muscle. This exposed the scapular aspect of the tumour, smooth, defined and so movable that it seemed as if it would have been easily turned out but at the neck of the scapula and around the glenoid cavity the growth was evidently from the bone or periosteum.

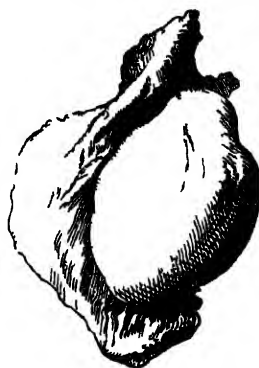


FIG. 14

teum, and was soft and cerebriform in substance, so that I proceeded to excise the whole scapula. With this view I entered the point of my bistoury over the clavicle internal to the attachments of the coraco-clavicular ligaments, and carried the knife backwards over the acromion into my first incision, so as to complete a long incision from over the outer part of the clavicle to the inferior angle of the scapula. I next made an incision from the superior angle of the scapula obliquely downwards and forwards over the tumour towards the neck of the scapula. The flaps of skin were then dissected and reflected, and the attachments of the trapezius and deltoid muscles to the spine of the scapula divided. I then cleared the clavicle by separating the attachments of the trapezius, deltoid, and great pectoral muscles, and divided the bone, dissecting through the coraco-clavicular fascia, so as to enable the axillary artery to be completely commanded. I now hooked my left forefinger under the coracoid process, and divided the attachments of the pectoralis minor, short head of biceps and coraco-brachialis muscles. The disarticulation of the humerus was next accomplished, and this required care, as the projection of the tumour around the joint made it necessary to be very cautious. The long head of the triceps was then divided, the scapula being carried backwards and drawn from the body, so as to allow me to divide the rhomboid and other muscular attachments with a single sweep of the knife. The loss of blood was very small, for in dissecting off the cutaneous flaps, and in separating the deltoid and trapezius from the scapula, all bleeding points were secured before proceeding farther. Subsequently, from the manner in which the axillary artery was commanded, no bleeding occurred, the subscapular and other vessels being secured before compression was relaxed. I expected to have had bleeding from the artery of the base of the scapula, but could scarcely find a bleeding point in its usual position.

Although there was so little loss of blood, the effect of shock was very obvious when the scapula was removed, as evinced by feeble pulse and sunken features. But this state speedily disappeared, and before the wound was dressed the pulse had recovered after the administration of stimulants.

After all bleeding had been arrested I examined the wound carefully, and noticed a series of elongated bodies of a prismatic form and a milk-white colour in the position of the axillary chain of glands, and these I dissected out. (They proved on examination to be glands, but contained no proliferous cells.) The whole surface was then washed with tepid carbolic water, and the flaps of skin having been brought together by sutures, a long flat pad of lint, enclosing "marine tow," was placed in the axilla and along the inside of the arm, which was then secured to the side by a broad flannel roller. The lines of incision were dressed with strips of dextrine oiled silk, wetted in carbolic lotion, and secured by gutta-percha tissue, glued down at the edges by touch: them with chloroform.

The following extracts from the report in the Hospital Journal will best show the subsequent progress of the case:—

"February 22d.—The patient has passed a tolerably good night; pulse 120; little discharge from the wound. He is getting milk and white of egg for diet, and occasional small portions of brandy and water and ice to allay thirst.

"24th.—Patient much as at last report, but troubled with severe bronchitic cough. Two stitches were removed to-day. The wound is looking very well and there is only very slight discharge.

"25th.—Patient has had less cough, but complains of dryness of his mouth. The tongue is moist and not much furred. Pulse has fallen to 108, and is of fair strength. Diet, milk with white of egg, beef-tea, and brandy. Quin in doses of 1 gr. with dilute sulphuric acid in water to be given thrice a

"27th.—The cough has again been severe, otherwise the condition of the patient is satisfactory. The discharge is very small in quantity, and has no odour. Some stitches were removed to-day, and the greater part of the incisions corresponding to the back of scapula seemed united by first intention. There is a little irritation and discharge at the wound over the section of the clavicle, and the head of the humerus has a tendency to press against the cicatrix at the upper part, causing it to break up.

"March 1st.—Patient going on favourably. Cough less. The tongue is slightly furred; pulse 108, regular, and good strength. Ordered a cathartic, as his bowels have been confined.

"4th.—Patient complains of feeling weak, and is very irritable, but his general condition is good. Pulse 104; temperature of skin natural. Diet, steak or chop, with sherry 4 oz., and 2 oz. of brandy.

"11th.—Patient is more cheerful; is still troubled with his cough, but takes his food well. Pulse 100. All stitches have now been removed some days since; all the large wound has closed, with the exception of the upper part, where the head of the humerus still tends to project, no matter how the arm is placed, and even when he is sitting up in bed with the elbow unsupported.

"13th.—Pulse 90; little or no discharge.

"23d.—Progressing favourably

"26th.—Patient has had a fresh attack of bronchitis, which has rather exhausted and dispirited him. The wound is healed, except at upper part, which is now contracting.

"April 13th.—Patient allowed to get up. Wound nearly healed over head of humerus. His cough is greatly better.

"May 7th.—Dismissed cured."

Remarks.—The cases in which excision of the entire scapula has been successfully performed are as yet few, and such instances as that just recorded are worthy of publication, as encouragement to operate. The foregoing case has, moreover, some interest in other respects, as regards the history and character of the tumour, and as drawing attention to the operative procedure which should be adopted to facilitate the after-treatment of the wound.

The tumour for which excision was performed presented some peculiarities when we contrast its vital manifestations with the structural appearance and invasion of other tissues. It had originally, and indeed up to a recent period, presented all the vital characteristics of a simple growth,—very slow progress, during twenty years, no pain, mobility and definition, and absence of any constitutional cachexia or disturbance; but its structure when cut into presented at one part all the appearance to the naked eye of medullary growth, and it had not only involved part of the capsule of the shoulder-joint, but had also infiltrated the neighbouring muscles and axillary glands which were removed.

These conditions were at variance with all my past observation of tumour growth. A very considerable experience had led me to lay down as an axiom that when a tumour was defined, of slow growth, and possessed of the other manifestations of simple tumours, we might safely reckon on its maintaining that benign character, however much it might alter locally—that is to say, such a tumour, though it might ulcerate

and adhere to other textures in consequence of local irritation, would not invade other tissues as malignant growths do; nor would it affect the constitution with true cachexia, and might be safely removed without risk of reproduction. In this, case, however, the section of the tumour, the involvement of other structures, and more especially the infiltration of the long head of the triceps and other muscles, and the neighbouring chain of glands, so impressed myself and others who saw it, that, on exhibiting the tumour to the Medico-Chirurgical Society, I expressed myself as rather shaken as to the views I had long held, by what seemed so marked an exception to what I had hitherto observed. Subsequent microscopic investigations, however, would seem rather to confirm the axiom I have long held, for neither in the medullary-looking part of the tumour nor in the altered axillary glands was there any appearance of cancer cells.



Fig. 195.



Fig. 196.

The trouble experienced in the after-treatment of the wound in this case has led me to consider the method of operating, and whether that might not be modified with advantage. The troublesome part of the treatment was the difficulty of obviating the constant tendency of the head of the humerus to be protruded at the upper part of the wound. Whilst the large posterior lines of incision corresponding to the body of the scapula healed almost entirely by the first intention, that part of the wound which corresponded to the outer end of the clavicle and acromion process was prevented from healing, and the cure rendered tedious, by the pressure of the head of the humerus, and also to some extent by the irritation caused by the edges of the section of the clavicle, and when this part of the wound did heal, the head of the humerus was adherent to the cicatrix (*vide* figs. 195 and 196).

In the special memoir of a successful case of excision of the scapula,

published by the late Professor Syme, no such difficulty is mentioned, but the reason is obvious. In Mr. Syme's case the head of the humerus had been excised some time previously on account of disease, and hence both the operation and after-treatment of the wound would be simplified.

At first sight it may seem that there would be little difficulty in obviating the protrusion of the head of the humerus. That by merely attending to position, keeping the arm at a right angle with the trunk, or elevating it so as to depress the head of the humerus, the object in view would be attained. Such was my own opinion at first, but when I tried to put these plans into practice I found that they did not answer my expectations. When the arch formed by the acromion and clavicle is removed and the scapula excised, the cavity of the axilla ceases to exist, and the head of the humerus, however placed, is close to the surface, and has a tendency to be drawn or pushed upwards by the action of the pectoralis major. Moreover, it was found impossible to retain the arm in the positions indicated for any length of time. The only method that had any effect, and that very slight, was fixing the arm by bandaging it to a broad roller fastened round the pelvis.

Resection of the head of the humerus in such circumstances is a very obvious method of getting rid of the difficulty, and Mr. Syme's case is an instance in point; but unless the part was implicated by the disease, I think it would be unadvisable to add to the risks of the operation by such complication if we can attain our object otherwise.

The method I would adopt now would be to disarticulate the clavicle from the scapula, instead of sawing it through. By this means we would avoid a source of irritation produced by the section of the clavicle, and at the same time by leaving the broad flat acromial extremity of that bone we would have a *point d'appui* with which the head of the humerus could be kept in contact, and so prevented from protruding, and there a false or new joint might ultimately be formed.

Such a procedure might render the operation in some respects more difficult, because by sawing through the clavicle, as in the case narrated, the operator can most readily expose the great vessels so as to enable the assistant to command them thoroughly, and he can also most easily expose and deal with the muscles attached to the coracoid process; whereas, in disarticulating the clavicle from the scapula, he requires to divide both the acromio and coraco-clavicular ligaments from above and behind, after separating the attachments of the trapezius, and to avoid division of the integuments below the clavicle. Practically, however, I believe the difficulty could not be great, for I have on one occasion excised the scapula by this method, in a case in which, after removing a large medullary cystic tumour from the axilla, I found there was a medullary growth from the subscapular fossa. In that case, owing to the exhausted state of the patient, I had to proceed very rapidly, and on the spur of the moment I divided the muscles attached to the base of the scapula and the trapezius, threw forward the scapula and arm, divided the coraco-clavicular ligament, separated the clavicle from the acromion, and removed the scapula after disarticulating the shoulder-joint. In Dow's case, I adopted what I considered the more

methodical plan of operating to secure against hæmorrhage, as already mentioned; but I believe that important object could be equally attained by direct compression above the clavicle through the incision necessary to separate the trapezius muscle, whilst the extent of the wound would be diminished, its after-treatment simplified, its healing expedited, and a more useful arm left.

CASE OF EMPHYSEMA AND PNEUMOTHORAX FOLLOWING FRACTURED RIBS.

Thomas T., *ætat.* 5 years, admitted into the Royal Infirmary, June 13, 1867, about 6 P.M., having been run over by a cab a few minutes before admission. One wheel had passed over his neck and the other over his chest, the latter having rested on his body a few seconds, according to the report of the police.

On admission his condition was as follows:—There was great emphysema of face, neck, and upper part of chest, rather greater on right side. There was extreme difficulty of breathing, very great lividity of lips and countenance, and the expectoration was tinged with blood. The larynx and trachea were apparently uninjured. The fracture of the ribs could not be distinguished on account of the great amount of puffy swelling, and the pain caused by any attempt at examination. On percussion of chest both sides were found resonant, but the right side gave a clearer and more ringing note than the opposite side. On auscultation, which was difficult, from the great amount of superficial crepitation and restlessness of patient, the ordinary respiratory sound were audible over the left side, but considerably exaggerated. On the right side they were absent, inspiration being inaudible, and expiration an abrupt blowing sound, perhaps transmitted from the opposite side.

After lying in bed for some time, the breathing became much calmer and easier, and the lividity of the countenance passed away; the emphysema, however, increased, and gradually extended over the abdomen and scrotum to the upper part of the thigh. In the evening free incisions were made through the skin and cellular tissue, in each axilla, and over the sternum. A large quantity of air then escaped, much to the relief of the patient.

June 14th.—This morning he seems and feels better. He slept somewhat during the night. The incisions have become glazed over with lymph, and the emphysema has apparently increased since they closed.

To-day he was ordered to have several small punctures made to evacuate more air from the cellular tissue; and the pulse being rapid and the skin hot he was ordered to get repeated small doses of antimony, 1-10th of a grain every three hours. A considerable amount of air escaped by the punctures. Percussion on right side is rather duller than it was yesterday, and the inspiration is faintly audible. The left lung seems to act freely, the breathing is easy, and the lividity quite gone.

June 15th.—Slept pretty well last night; emphysema considerably less than it was yesterday, although still considerable over chest, abdomen, face, and arms; the eyelids are less swollen, and he can open his eyes. The breathing is quite easy, and general appearance much improved. Percussion on right slightly duller than on left side; right lung seems to have begun to act again, and the respiratory signs are returning. On the left side respiration seems to be going on freely, and the sounds are still slightly exaggerated. Antimonials continued.

June 20th.—The emphysema still continues a little ; slight bronchitis has commenced on left side. The pneumothorax has decreased, and the right lung seems to be acting more freely. The antimonials continued.

June 22d.—Emphysema much better ; the incisions are healing fast ; pneumothorax is disappearing, and the right lung acting distinctly ; bronchitis is much relieved, and the breathing is tranquil and easy.

June 30th.—Has progressed very favourably since last report. Slight emphysema still exists in scrotum.

July 6th.—Is nearly well, except that there is considerable flattening of chest on the right side. The incisions are nearly healed. Dismissed cured on the 18th of July.

This case illustrates the plan of treatment recommended in Lecture XCVIII., pp. 953 and 954.

LECTURE XCIX.

ABDOMINAL WOUNDS : their Nature, Variety, Risks, Complications, and Treatment, General and Special—Traumatic Peritonitis : its Symptoms, Pathology, Prognosis, and Treatment—The Operation of Paracentesis Abdominis : when and how to perform it—Chronic Abdominal Abscess, Diffused and Circumscribed—Perityphlitis—Iliac, Lumbar, and Psoas Abscess : Diagnosis and Treatment.

IN WOUNDS OF THE ABDOMEN, as in those of the chest, the danger is great in proportion as the wound is penetrating or superficial ; but even in a wound of the abdominal parietes, at certain points there are special risks. Along a certain line we have the branches of the internal mammary artery, and, lower down, the great internal epigastric artery, which may be injured in a non-penetrating wound of the abdomen. The blood may become effused between the fascia transversalis and the peritoneum, or into the sheath of the muscles, and thus a very large amount of blood may be lost, sufficient to debilitate or even to cause the death of the patient. In such cases, of course, the state of the wound, its direction, the general symptoms of hæmorrhage, and the peculiar low state of the pulse, would indicate what had happened, and then we should enlarge the opening so as to get at the bleeding-point, and secure the vessel by ligatures.

Where the wound is non-penetrating, and no great bloodvessel is wounded, there is still another risk, not immediate, but secondary—the risk that, from the weakening of the abdominal parietes, a traumatic hernia may occur afterwards. The abdomen may be wounded, the wound dividing the fibres of the external and internal oblique and transversalis muscles, but not injuring very materially the fascia transversalis, and not penetrating the peritoneum. This is strictly a non-penetrating wound. If the fibres be divided more or less transversely, they yield ; the action of the diaphragm, and other muscles of the abdomen compress the viscera, they are forced towards the weakest point, and a traumatic hernia occurs. The peritoneum, with a portion of the bowel, is projected through the opening ; and hence, although the wound be non-penetrating, there are special dangers attending it connected with the locality in which it occurs. In all such cases, when the wound divides a considerable thickness of the abdominal parietes, we should take means to support that point by deep sutures and a pad and bandage until union has occurred, not only superficially, but at the deep part. After operations, as for ligature of the external and common iliac arteries, the parietes must be weakened ; this cannot

be avoided, and we therefore take means to support the weak point, and prevent the risk of a hernia occurring, by appropriate dressing.

The great risk, however, in abdominal wounds is penetration into the cavity of the abdomen, and lesion of some of the contained viscera. Here, as in the chest, we should not be too anxious to make a correct diagnosis at first, by probing, for we may safely trust to the indications which will be given if any lesion of the abdominal organs has occurred. We must be very careful, however, in forming an opinion as to what part of the viscera may have been wounded, for the viscera of the abdomen are subject to great changes in their position, according to their degree of distension. I have seen a wound about midway between the lowest rib on the right side and the umbilicus, where the stomach was injured, which could not happen in ordinary conditions. The wound, however, was received shortly after dinner, when the stomach was fully distended. In a few hours vomiting of blood came on to a considerable extent, and the man died within twelve hours in great agony from acute peritonitis. In this case the distension of the stomach explains its being wounded in so unlikely a position. In small punctured wounds we cannot be sure what part is injured, except, perhaps, the stomach, in which case the character of the vomiting which occurs speedily, shows the nature of the injury.

The principle of *Treatment* is the same in all cases : whenever there is a suspicion that the viscera are wounded, we should give opiates internally, and also opiate enemata. As regards food, the less given the better : ice or iced milk may be given, but the use of nutrient enemata is perhaps the best method of nourishing the patient for the first day or two. The object is to avoid everything likely to excite the peristaltic movements of the intestine, to allow the wound in the viscera to become covered over with lymph, and to prevent the possibility of the parts being distended with food. The risk of internal hæmorrhage cannot be guarded against, the only thing we can do is to apply cold and exhibit ergotin hypodermically ; but, after all, these are very trivial measures when the vessel wounded is of large size. Sometimes we are able to tie the wounded vessel ; but in these cases the amount of injury done renders the case a very hopeless one. I have seen a case where a portion of the bowel with the mesentery was injured, and branches of the mesenteric artery torn, in which I was able to tie the wounded vessels ; but in such a wound, whilst the surgeon is bound to arrest hæmorrhage and use every precaution, it is evident that the chances of a favourable result are very small.

In some cases of penetrating wounds of the abdomen a direct traumatic hernia may take place ; the bowels are protruded through the wound. When this happens, the intestine must be examined carefully to see if it is wounded, and also to see that no arteries are injured. Where a penetrating wound of the abdomen, with protrusion of the viscera, has occurred, we find that in most cases, from the patient falling on the ground, a quantity of dirt and dust has lodged on the surface of the intestines. The intestine must therefore be washed to get rid of this, and this is done by pouring lukewarm boracic or weak carbolic lotion very gently upon it, without handling it much, though

we may turn over convolutions of the gut to see if any part of it has been wounded, whether any perforation of the bowel has taken place, or any bloodvessel at the root of the mesentery been injured. When the intestine is wounded we may introduce a few points of herring-bone or glovers' suture, of carbolised catgut, if the wound be small.

When the wound is larger the same suture may be used, but the chance of recovery is much less if we stitch it up and return the bowel into the cavity, than it is if we make an artificial anus, and so allow the fæces to pass by the external wound. A large wound of the intestine is always a most unfavourable condition. If the upper portion of the jejunum be wounded, the prognosis is very unfavourable, for then the food is not fully digested, and the patient is likely to die from inanition, independently of the peritonitis and other conditions which may arise.

If the bowel be not wounded it should be returned into the cavity of the abdomen. In returning a considerable portion of the small intestine, there is a very great risk in pushing it inwards, especially if the wound be not very large, that it may be pressed up between the fascia transversalis and the muscles, or between that fascia and the peritoneum. The portion of the intestine is thus pushed back out of sight, apparently within the abdomen, but really external to the deep wound in the peritoneum, which is probably small. The protruded portion of the gut will thus become constricted. Hence we should always follow the intestine with the finger during reduction, to make sure that it passes fairly back into the abdomen. I have seen more than one case in which the above-mentioned accident has happened. If we find, on passing the finger deeply, that the opening in the peritoneum is small in proportion to the mass of intestine protruded, we must enlarge the opening so as to allow the reduction of the bowel to be effected without force or much manipulation. When the intestine is completely returned we stitch up the external wound with deep sutures, after having first checked all bleeding from its margins. Then a pad and a spica bandage are applied as after the operation for hernia, so as to support the weak point of the abdomen, and prevent protrusion recurring.

Opiates must be given, to procure rest and allay irritation in the part which was protruded, and also to prevent the action of the bowels for a time, for if they begin to act soon after the accident the irritation produced may give rise to acute peritonitis.

In some cases a small portion of gut may be protruded from the deep wound between the muscles or under the integuments, without appearing externally. If not noticed this may become constricted. In such circumstances the symptoms of acute incarceration, or strangulation of the intestine, will supervene, as in hernia; and when there is much pain felt locally, and some fulness near the wound, with vomiting, or tendency to vomiting, no time should be lost in enlarging the wound, to examine and return the gut or omentum if protruded.

PERITONITIS is one of the most dangerous complications of wounds or operations in the abdominal region. The symptoms which indicate

it are, great pain, of an acute, burning, and persistent (not spasmodic) character, extending gradually from the vicinity of the wound over the whole abdomen. This pain is greatly increased by pressure over the abdominal surface, or by stretching out the lower limbs. The patient generally lies with the limbs drawn up and the thighs flexed on the pelvis, to relieve tension. The features at first are flushed, and have an anxious expression; the skin is hot and dry, and the urinary secretion diminished. The pulse varies from 98 to 120 beats per minute, and has a hard wiry feel. The tongue is at first of white milky appearance, but soon becomes foul and loaded. As the disease proceeds, the belly becomes tense and tympanitic, and vomiting supervenes, at first of a bilious character, but subsequently of dark greenish watery fluid. When the disease progresses to a fatal termination the vomiting, or the attempt to vomit, becomes almost incessant. The features become sharp; the pulse increases in frequency, but becomes weak and irregular, and the patient gradually sinks.

The pathological conditions resulting from peritoneal inflammation are, increased serous effusion and exudation of plastic lymph. In the acute sthenic form of the disease, the soft plastic exudation is thrown out rapidly in large quantities, matting the convolutions of the intestines by adhesion of their peritoneal surfaces, and interfering with their functions. In cases where the acute action is overcome, and the patient survives, the soft recent adhesions gradually become elongated, and of filamentous character. In some forms of peritonitis, and when the action is limited, the surface of the membrane loses its smooth glistening character, and becomes rough and granular from deposit of lymph on its surface, a condition often met with in strangulated hernia in a portion of bowel above the protrusion. In some instances the very intensity of the action would seem to prevent organic change. Thus, in two cases of rupture of the bladder, where the patients suffered from all the symptoms of intense peritonitis, I found no apparent change in the peritoneum, no increased vascularity, no recent adhesions or flakes of lymph, and no effusion, with the exception of about two ounces of turbid fluid, of a urinous odour, in the recto-vesicle pouch of the peritoneum. It seemed as if the very excess of the disease had so depressed the vital powers as to prevent the plastic or serous effusion taking place.

The prognosis in surgical peritonitis following a wound, or arising during the progress of a hernia, is much less favourable than in ordinary idiopathic peritonitis. The *Treatment* will be modified by the nature of the wound and other circumstances in individual cases, but the general indications are, to allay pain by the exhibition of opium, either alone or in combination with calomel, and given at intervals of three or four hours—warm fomentations over the abdomen at and near the wound, and the application of a blister over the belly at a part more remote from the wound. In surgical peritonitis it is not very often that the patient can bear depletion. In cases of wounds the previous loss of blood, and in cases of hernia the exhaustion consequent on the diseased condition generally, contra-indicate it. In some cases, however, of young robust patients, or when the pain is very acute and the

pulse hard and firm, depletion by leeches over the abdomen or by venesection may be used advantageously at the early period of the diseased action, but not when effusion or tympanitis has set in. The use of laxatives must depend on the state of the viscera. In most cases of surgical peritonitis we require to keep the intestines at rest, for a time at least, and therefore we refrain from using this class of remedies.

In your practice as surgeons you will be frequently called on to perform PARACENTESIS ABDOMINIS, for the purpose of drawing off collections of serous fluid in cases of ascites. In the majority of such cases the surgeon is called in by the medical attendant to perform the operation, in consequence of the accumulation of fluid interfering with the respiration and circulation. From the very nature of the originating causes of the effusion in most cases of ascites, tapping the abdomen is had recourse to rather as a palliative than as a curative operation. I have, however, seen some instances where a certain amount of organic affection of the kidney was the cause, and where all diuretic remedies had lost their effect, in which the operation of paracentesis not only relieved the patients temporarily, but the medicinal remedies seemed to regain their effect, and the action of the kidney was restored. In some of these cases the patients recovered and lived for years afterwards. These, however, are exceptional cases: in most instances the fluid rapidly reaccumulates, and the operation requires to be repeated from time to time to afford relief. The operation, therefore, should not be hastily performed at first, until other remedies have failed to diminish the collection, or when it is interfering with the function of respiration. In all cases the surgeon must satisfy himself as to the diagnosis and state of the patient before operating, for sad mistakes have occasionally occurred. In ascites the fluid collects gradually, and is not confined at first to one side, as in ovarian disease. The abdomen is equally distended throughout, the fluid lying in front of the intestines, except in some cases where previous adhesions limit the fluid in certain directions. In all cases, percussion and palpation of the distended abdomen should be carefully employed, to ascertain whether the swelling is caused by fluid, and also the relation of the hollow viscera in each case, for the colon has been punctured through carelessness in operating. It sometimes happens that in cases of acute or subacute peritonitis a form of acute ascites takes place; but interference in such cases is generally disastrous. The fluid drawn off forms a gelatinous mass as it cools, and the temporary relief afforded by its removal is soon followed by fresh exacerbation of peritonitis, accompanied with typhoid symptoms. In such cases the symptoms must be very urgent and painful to warrant interference; and from what I have seen I would say it is better not to interfere at all.

When, however, you have satisfied yourself of the propriety of performing paracentesis, the operation, though a simple one in itself, requires some careful arrangement of the patient. If the fluid be carelessly or too rapidly drawn off, fatal syncope may be induced, or distended veins suddenly deprived of the equal fluid support might give

way, and internal bleeding prove fatal. The patient should be seated on the front of the bed, supported by pillows. A broad cotton binder, split at each end into three tails, is placed round the patient, the ends crossed behind, and given in charge to two assistants, who, by drawing them in opposite directions, tighten the binder as the fluid escapes, and thus keep up equal pressure on the abdomen during the operation. A longitudinal slit is made in the bandage in the middle line, so as to enable the surgeon to ascertain the position of the umbilicus. The point of election for puncture is about midway between the umbilicus and pubis, or rather nearer the umbilicus. In all cases the patient should be made to empty the bladder, or the catheter should be used as a precautionary measure, to ensure the bladder being below the level of the pubis. The operator then inserts the trocar and canula exactly in the middle line corresponding to the linea alba, at the point of election already indicated. If he uses a large trocar, he should, as he withdraws it from the canula, place his finger slightly over the orifice to moderate the gush at first, and then the binder is gradually tightened as the fluid is drawn off. It occasionally happens that towards the latter part of the operation the flow of the liquid through the canula is suddenly interrupted: this is due to some part of the omentum or intestine falling over the orifice. In these circumstances, by a slight change in the position of the patient, or by gently pushing aside the obstruction with a probe introduced through the canula, the flow is re-established.

When the operation is completed, the split ends are brought round and pinned in front to give support. A small piece of adhesive plaster is placed over the puncture, and the patient placed in bed. During the operation a little wine may be given if the patient feels faint; and he may require to be placed recumbent if very weak.

If the puncture be made at the part of the abdomen I have indicated, bleeding cannot take place, except it be from distended veins, or some peculiar condition of the parietes. I recollect one case in which I was asked to operate, because on a previous occasion, when the patient was tapped, very profuse arterial hæmorrhage had taken place. On the occasion I performed it all went prosperously, but about a year afterwards the woman died, and I was present at the examination of the body. There was malignant disease of the uterus, and the lower and forepart of the parietal peritoneum was covered by a growth of a pulpy or spongy and vascular character, about three-fourths of an inch in thickness. This had been punctured in the first tapping, and my puncture had merely escaped touching it by about half-an-inch. That, however, was the only case in which I ever knew of active bleeding taking place when the puncture was in the middle line.

ABSCESSSES IN THE ABDOMINAL PARIETES require great care to be exercised in their diagnosis, in case they should be mistaken for other diseases, and wrong treatment adopted. I have occasionally seen a low form of suppuration over and along the course of the spermatic cord in the inguinal canal, where the progress of the diseased action was slow, and yet attended with great pain and general irritative fever.

In such cases the swelling is seen and felt superficially, but the pus is deeply seated, and requires to be evacuated by cutting down upon the canal, as in a case of hernia, to avoid risk.

We not unfrequently meet with EXTRA-PERITONEAL CELLULITIS at different parts of the abdomen. The most usual locality of this form of diseased action is the iliac fossa of either side. But it occurs generally in the right iliac fossa, in the loose connective tissue about the caput cœcum coli (perityphlitis). Extra-peritoneal cellulitis, however, may occur at any part of the abdominal parietes, and we occasionally see it in the form of apparently circumscribed swelling or abscess, high up in the umbilical or hypochondriac regions. The diseased action is often traceable to some local irritation—the presence of undigested matters, as portions of bone, fruit stones, and the like. At other times the history is more obscure. The patient's digestive functions may have been disordered, and the patient may have suffered from continued flatulence. Then pain of a peculiar but subacute character is complained of, and referred to some exertion or strain. There is often a distinct rigor felt at first, but in other cases only some slight chilliness. Deep-seated hardness can be felt, and percussion is dull over the part. The pain, though not always acute, is persistent and sickening, and the general health is affected perhaps to a greater degree than the amount of the local disease would seem to account for, except we keep in mind its true nature and the relation to the viscera, and the probability that in many cases the general disturbance of the digestive organs has culminated in the local inflammation. In cases where the diseased action proceeds slowly to suppuration, the local induration and the anxious cachectic look of the patient may even lead to a suspicion of malignant disease. In the more ordinary form of perityphlitis the disease generally runs its course more rapidly, and there is less difficulty in diagnosis than in the limited cellulitis under other parts of the abdominal parietes.

In cases of extra-peritoneal cellulitis there may be a great amount of inflammatory infiltration, with rigors and sympathetic fever, and yet, under proper treatment, the effusion may disappear without suppuration taking place.

We should therefore be very cautious before making incisions in such cases. It is well to wait a little for decided symptoms of suppuration before cutting through the parietes.

In iliac abscess when an opening is indicated, the incision should be made in the line of Poupart's ligament, near the anterior superior spine of the ilium, unless the abscess be pointing elsewhere, and then we follow the indication afforded by the natural process. The after-treatment is the same as that of an ordinary abscess, only we require to watch lest ulceration of the bowel should occur, and fœcal fistula should form. In cases of circumscribed abscess in the iliac fossa in connection with the intestine, the ulceration is sometimes large, and leads to artificial anus. This form of artificial anus is said to be more difficult to heal than that arising in gangrenous hernia, but my experience of a few cases of this kind, which have come under my own care,

is different. They all did well; the opening contracted, and the faeculent matters gradually passed by their natural channel as the wound healed, and no surgical interference was required.

When purulent collections in the iliac fossa on the subperitoneal surface of the fascia are chronic and diffuse, they may closely simulate femoral hernia. The internal cribriform fascia in the first instance, and next the external cribriform fascia, yield before the gradual pressure of the pus, and a rounded swelling is felt at the femoral ring. The swelling is projected more distinctly when the patient coughs, and it communicates a feeling of impulse to the finger. There is no acute pain; merely uneasiness. When the patient is placed recumbent the swelling returns into the abdomen, and if the finger be placed over or pressed upwards into the femoral ring, and the patient desired to rise up, the swelling is retained; but when the pressure of the finger is removed, it again reappears. Now these symptoms are very similar to those of femoral hernia, but there is usually something in the appearance of the patient, or in the history of the case, that leads us, if we be on our guard, to arrive at a right conclusion. Amongst other diagnostics I would direct your attention to the fact that in such cases, although we can reduce the swelling readily enough, and can retain it, as already stated, by pressure for a time, yet gradually it descends; or if a truss has been used, the swelling makes its way from under the pressure, however accurately the truss may fit. In such cases the ordinary treatment of chronic abscess must be had recourse to.

The terms LUMBAR and PSOAS ABSCESS are used to denote sub-acute or chronic purulent collections arising in the substance of the psoas muscle or the cellular texture around it, and are very generally connected with caries of the vertebrae. Sometimes the collection of matter is somewhat circumscribed, and projects or points in the lumbar region at the anterior free margin of the quadratus lumborum muscle, and then it is termed a lumbar abscess. More frequently, however, the pus burrows down along the psoas muscle into the iliac region, passing below the fascia iliaca, and points at the upper and inner part of the thigh under the iliac portion of the fascia lata, having followed the course of the psoas tendon to its insertion, and in such circumstances it is termed a psoas abscess. In treating this form of abscess, whether we open it in the lumbar or crural region, we must bear in mind that it generally arises in connection with an unhealthy state of the constitution, and hence that, under any method of treatment, irritative fever may supervene.

When the matter is homogeneous, and not curdy, we may draw off the pus by means of the aspirator, the exhausting syringe, or with tubing under water, as I described when lecturing on chronic abscess; but if, as is generally the case, the pus is of unequal consistence, it is better to make a free incision to permit of the pus being fully evacuated, and in doing this you may use a piece of folded lint, soaked in carbolic oil, laid over the part. The incision should be made through one fold of the lint, and then the other fold allowed to fall over it; the pus escapes by the sides, or soaks through, and when the pus has all

escaped, the cavity should be syringed out with carbolic or boracic lotion, a fresh piece of oiled lint is laid over the opening, and covered with gutta-percha tissue, and a soft towel folded is placed over all, supported by a bandage; or the special antiseptic method may be followed. If any irritation follows, this dressing must be removed, and ordinary poultices, or cotton wool soaked in warm water and covered with gutta-percha tissue applied. Subsequently the cavity may be washed out with weak carbolic lotion, or the chlorinated soda lotion, or watery solution of iodine. When the abscess projects, and requires to be opened in the inguino-femoral region, you must keep in mind the position of the great vessels which are sometimes displaced by the collection; but the more general risks are injury of the saphena vein, or branches of the inguino-pudic artery, or branches of the internal circumflex artery; and hence the incisions should be made after careful examination of the prominent part of the swelling, to avoid any large superficial vein, and to ascertain that no artery is felt pulsating at the point you intend to make your incision or enter the trocar.

LECTURE C.

HERNIA: Definition of the term—Mechanism of Abdominal Hernia, and Nature of the Protrusion—Formation of the Hernial Sac, and its relations to the Visceral Peritoneum—Structural Changes which the Sac and its contents undergo—the Fascia Propria: whence derived and how distinguished.—Contents of the Sac—Enterocoele—Epiplocele—Entero-epiplocele—General Diagnostics and Classification of Herniae: its Symptoms and predisposing and exciting Causes—Mr. Vincent's views on the Action of the Diaphragm—Treatment of Reducible Hernia—Application and Adaptation of Trusses.

IN entering upon the subject of ABDOMINAL HERNIA, I cannot help feeling how inadequately I can treat of so important a department of surgery in the space I can devote to it in a course of Lectures in which so many other diseases must be considered; and I feel the difficulty all the more, perhaps, because I have had, owing to various circumstances, a larger amount of experience in hernial cases than falls to the lot of most surgeons. This renders the task of condensation more difficult; for, with the practical knowledge that there are scarcely any two cases of hernia exactly alike, and that these individual peculiarities have important bearings on the practice in each case, it is not easy to lay down a few general principles when exceptional conditions are so numerous. The value of experience in such circumstances is rather in regard to details and emergencies in complicated cases. I shall, however, attempt to bring before you, as succinctly as I can, some general principles of action, embodying and founded on results tested by my own experience.

By the term hernia we mean a protrusion of a part of the viscera through some weak point in the abdominal parietes, generally through some natural canal or opening which has become dilated, or through some adventitious aperture, caused by separation of aponeurotic fibres, from distension of the abdominal parietes. Except in cases of direct penetrating wounds, protrusion from forcible laceration of the abdominal walls must be very rare, if it ever occurs. Hence the popular term, Rupture, so frequently used to designate this disease, is an improper one, and likely to mislead as to the true state of matters.

I have said that the protrusion usually takes place through some natural opening or along some natural canal. It does so by slowly distending the apertures through which it passes. Or it may happen that the natural structures passing through a canal may, owing to disease, become increased in bulk, dilate the passage, and subsequently return to their natural size, or undergo atrophy. In consequence of

these changes the calibre of the canal is relatively increased, and a hernial protrusion will be likely to occur. Thus I have known a case in which, after subacute orchitis and swelling of the spermatic cord had existed for some time, these structures became completely atrophied, and a hernial protrusion took place and became strangulated. The same tendency exists after the cure of cirsocele, where the inguinal canal has been dilated by the varicose veins of the cord. Again, in consequence of continued distension of the abdominal parietes, from any cause, the fibres of the aponeurotic portions become stretched and separated, or apertures for the transmission of bloodvessels may become dilated, and thus weak points are created, through which, under certain circumstances, herniæ may occur. We have examples of these last-mentioned conditions leading to hernia, after ascites, or in females after repeated pregnancies. In such cases the textures which have been temporarily distended become relaxed, and their fibres stretched; and under these circumstances ventral or umbilical herniæ frequently occur, without any rupture of the parietal structures.

Having considered the manner in which hernia usually takes place, I next proceed to point out to you the nature or character of the protrusion. In general terms a hernial protrusion may be said to consist of some portion of the hollow viscera of the abdomen, or of the floating omentum, or of both, invested by a protrusion of the parietal peritoneum, which is termed the hernial sac. The nature of the hernial sac, in relation to its contents and the abdominal walls, and the structural changes which it undergoes, are of great practical importance in reference to diagnosis and treatment. We also require to notice the exceptional cases in which the sac is absent.

If we examine the interior of the abdomen in its natural state we observe that the peritoneum is reflected from off the viscera, on the inner surface of the parietes, to which it is closely connected at some points, but more loosely at others, to admit of the varying distension and movements of the abdominal viscera. When we look at the parietal peritoneum where it covers the deep opening of the inguinal canal, or the deep femoral ring, we notice a slight indentation or depression, corresponding to these apertures,—digital fossæ of the peritoneum, as they are termed anatomically, from the resemblance of the depression to a slight indentation caused by the tip of the finger. When a hernia begins in either of the situations indicated, the pressure of the descending protrusion impinges on this shallow pouch, which gradually yields before it, so as to form its investing covering or sac, and so in other forms of hernia, with slight modifications.

If you have followed my description of the formation of the sac from the parietal peritoneum, and recollect the relations of the visceral peritoneum, you will easily understand that the exceptional cases in which the protruded viscera have no peritoneal sac are rare, and almost limited to hernia of the iliac aspect of a portion of the caput cœcum coli where that viscus is not invested by the serous membrane. It does not follow, however, that the sac is absent in all cases where the caput cœcum coli forms the protrusion. I have operated on cases of both inguinal and femoral hernia containing the caput cœcum; in all of

them the peritoneal sac was present as usual, and opened, though in reducing the intestine its extra-peritoneal surface came into view. I apprehend that the manner in which the cœcum descends makes the difference. If it be pushed down, so turned on itself as to present its iliac or extra-peritoneal aspect, then the sac will be wanting; but in my own cases I have never met with this condition.

Congenital hernia is sometimes mentioned as another example, but not correctly, for in it that continuation of the general peritoneum forming the tunica vaginalis is the sac of the protrusion. The serous sac projected before a hernia is at first loosely connected to the surrounding textures, and its contents are free and unadherent. In old herniæ, however, the sac is generally more or less adherent by its posterior aspect, and very frequently closely adherent to the parts more immediately covering it. In small femoral herniæ we often find the fascial coverings, the glands, and the sac, all inseparably blended.

Perhaps the most important conditions of the sac are those structural changes which take place in it, and the adventitious connections formed between it and its contents. The portion of peritoneum forming the sac is liable to alteration in consequence of long-continued irritation, abnormal nutrition, and inflammatory action, resulting in plastic deposit, thickening, and adhesions of the visceral contents to the sac. These adhesions may be either short and close, or long and filamentous, and of course interfere more or less with the functions of the viscera and the reducibility of the hernia. The whole sac may be enormously thickened and altered in appearance and structure, so as to lose all semblance of serous membrane, as you may observe in the sac of an old scrotal hernia. Generally, the body and fundus of the sac retain their natural appearance, or are but little altered; whilst the neck, or those parts which are subjected to constriction and pressure by the resisting structures of the apertures or canals through which the hernia is protruded, become thickened, condensed, permanently narrowed, and resistant. It is owing to this alteration in structure that the neck of the sac is so frequently the seat of constriction in hernia. In the same changes we find an explanation of constrictions at different parts of the sac—termed by French writers “sacs aux collets.” A protrusion has existed of a small size for some time, probably a truss has been worn, and the neck of the sac has become contracted and thickened; a larger protrusion pushes down before it the old sac with its constricted neck, and this may give rise to special difficulties in operating should the hernia become strangulated. (See case of Peter B. in Clinical Cases.) When the sac is thin, the continuous pressure of its contents seems to efface it at some parts. I have seen two instances of this in old ventral hernia, where the omentum was adherent to the subcutaneous fat, whilst the sac was perfect at all other points. This change, however, must be exceedingly rare, and I have never met with it in any form of hernia but the ventral.

The coverings of a hernial protrusion vary according to the part at which the protrusion occurs; but there is one covering which requires to be specially noticed—namely, that layer of condensed, fibro-cellular tissue termed the fascia propria of a hernia. This, the immediately

investing covering of the sac, is derived from the margins of the deep opening through which the hernia has protruded. The deep ring or aperture is in some fascial or aponeurotic structure, and the margins of the opening are not defined and abrupt, but are gradually prolonged downwards in a funnel form. Thus, for example, in oblique inguinal hernia the margins of the deep ring in the fascia transversalis are gradually prolonged on the spermatic cord; and when the hernia occurs the sac and its contents are insinuated in front of the cord, beneath this layer, and hence it receives the title of the fascia propria of oblique inguinal hernia. Now, this layer of thin condensed fibro-cellular tissue, from whatever source derived, lies in close contact with the sac, and is moulded to the form of the protrusion which it invests. Like the sac itself, this fascia is subject to pressure, and gradually becomes thickened and condensed; portions of its deep surface, or of the fine extra-peritoneal cellular tissue often adhere to or closely embrace the neck of the sac, so as to form a constriction which may appear to be in the structure of the sac itself; and yet, by carefully dividing this condensed tissue, the constriction may be relieved and the protrusion returned without opening the sac; and it is therefore important to keep this in mind in reference to the extra-peritoneal operation for strangulated hernia. Another thing to recollect is, that during an operation this texture, in cases of strangulated hernia, especially in femoral hernia, is fine, smooth, and not unlike the sac itself when closely applied over the swelling. You will, however, generally be able to satisfy yourself of its real nature by observing that it is prolonged indefinitely upwards on the swelling, owing to its continuity with the margins of the aperture through which the hernia protrudes. Whereas, when the sac is fairly exposed, the sharp defined margins of the aperture can be felt, though tightly constricting the protrusion.

The contents of the hernial sac may consist either of intestine alone, constituting what is termed enterocele; or of omentum only—epiplocele; or of both intestine and omentum—entero-epiplocele. The portions of the hollow viscera which may form the contents of the sac are various. Different parts of the colon or of the small intestine, and even the urinary bladder, have been found in hernial tumours. The portions of the intestine, however, most frequently met with are the ileum, occasionally the lower part of the jejunum, of the small intestine, and the caput cœcum or part of the sigmoid flexure of the colon in the case of the large intestine. The presence of omentum in the sac will modify both the physical and general diagnostics in reducible hernia, and will to some extent protect the intestine in cases of constricted or strangulated hernia, by diminishing the direct effects of the constriction on the intestine.

The diagnostic symptoms of hernia, in reference to other abdominal swellings, will be better discussed when speaking of the special herniæ. At present I shall merely indicate the absolute diagnostics in a case of simple reducible hernia. These may be described in general terms as consisting of a colourless elastic swelling, more or less distinct, at some part of the abdominal parietes, which has either appeared gradually, or been first noticed after some sudden effort. When the hand or finger

is applied lightly over the swelling, and the patient is desired to cough, a distinct and direct impulse is communicated to the tumour, and probably an increase in its bulk takes place. On laying the patient in the recumbent posture, the protruded parts generally return spontaneously into the abdomen, or the slightest pressure effects their reduction. If, after reduction of the swelling, the finger be passed upwards, the aperture through which the protrusion had descended will be felt; and if the finger be kept there, and the patient desired to resume the erect position, though impulse will be felt against the finger, the protrusion will be retained. On removing the finger it will again descend. If the protrusion is composed of intestine, the return of the gut is attended with a peculiar gurgling sound. When the protrusion is omental, the swelling is not elastic, as in the case of intestine; it has a doughy feeling, the impulse or coughing is less distinct, percussion over the swelling is dull, and the reduction of the mass is not so readily accomplished as in the case of protruded intestine—the last portion requiring the same amount of manipulation to return it as the mass, and there is no gurgling sound as in the case of the intestinal protrusion. The clearness or dulness on percussion cannot be altogether trusted to, for in many cases of hernia the intestines are distended with fæces, solid or fluid, with little or no gaseous contents, and then percussion gives a dull sound.

The general symptoms present in a reducible hernia are not very marked. In some instances, when the protrusion first comes down, the patient feels sick, has griping pains in the abdomen and in the swelling. In cases of large omental protrusion there is usually a peculiar dragging sensation at the stomach, accompanied with nausea, and even slight vomiting, although there may be no constriction. In many cases of reducible hernia the patients feel so little uneasiness or pain that they too often overlook or under-estimate the serious character of the swelling, and satisfy themselves with returning it when uneasy, without even consulting a medical practitioner, or wearing a truss.

We now proceed to consider the causes which lead to the protrusion. These are divided into predisposing and exciting. The predisposition to hernia consists in any defect, either congenital or acquired, in the abdominal parietes, which renders them less able to resist impulses which project the viscera against the weakened parts, and are similar, or rather the same, conditions I have already mentioned when describing the descent of a hernia. The exciting causes are chiefly due to the action of the abdominal muscles upon the contained viscera, forcing them towards the weak points in the parietes. This may occur under different circumstances—as, for example, from some sudden and violent effort; or as the result of frequent, though less violent, muscular efforts continued during a long period of time, as in certain chronic diseases, such as stricture, or enlarged prostate, when the abdominal muscles are called into action to assist the muscular coats of the bladder to overcome the obstruction; or in cases of chronic bronchitis, where the diaphragm and other abdominal muscles are called into action by the constant efforts in coughing. In either

the sudden or more chronic form, if you recollect the elastic and mobile nature of the floating viscera, and consider the effect produced on them when pressed on from above and below by the opposing forces of the diaphragm and levator ani, and from before and laterally by the recti, oblique, and transversales muscles, you will understand how the elastic mass so compressed tends to escape towards the least resisting points of the parietes, and to be protruded, either suddenly or gradually, at one or other of the weak points, according to circumstances.

In regard to the part at which the protrusion may take place, that will depend partly on some predisposing weakness in structure, as already explained; partly on the shape of the abdomen and pelvis; and partly on the form of the diaphragm, as tending to cause the force to impinge upon certain points rather than others. The late Mr. Vincent, in his work on *Surgical Practice*, explains this effect produced by the diaphragm by reference to its figure and the curves of its muscular fibres. "The figure of the diaphragm," says he, "is that of an arched dome; but having a tendinous expansion in the middle, it is divided into two arches of muscular fibres. Now it is clear that if a muscular fibre take a curved form, every point in the curve will act in the direction of the versed sine to that point; or, what comes to the same thing, to the perpendicular of the tangent of the point. If the curves of the diaphragm were those of a sphere, these perpendiculars would all concentrate in one point; but this not being the case, the perpendiculars will be directed more copiously on some directions than on others—that is, the action of the muscle will be transmitted with greater force to some parts of the boundaries of the abdomen than to others, and thus determine the seat of hernia. If the chest be narrow the direction of the accumulated impulses may fall low, as well as if the distance from the diaphragm to the pelvis be but little, and so an increased impulse may be directed to the femoral ring, accounting for this seat of hernia in females. It is by no means uncommon to see an immense bulging above Poupart's ligament. The aponeurosis of the external oblique appears to be extenuated in these cases, and to yield prodigiously, so as to put on the appearance of a ventral rupture, the part being powerfully forced out on the patient's coughing. This is clearly the effect of the action of the diaphragm, by which the accumulated forces are directed to this spot."

We come now to the classification of hernia, under the two heads of Reducible and Irreducible. These terms scarcely require any explanation. By the former we mean a hernia which can be reduced or returned into the abdominal cavity by gentle manipulation and attention to position, or which even returns spontaneously when the patient is placed in the recumbent posture. The objective and general symptoms of reducible hernia I have already described when speaking of the diagnosis of hernia, and I need not repeat them, but merely advert to its *Treatment*, which consists in the reduction and retention of the protrusion. Reduction is accomplished by placing the patient recumbent, with the shoulders and pelvis slightly raised, and the lower limbs

flexed on the pelvis, so as to relax the abdominal muscles; whilst, to prevent the undue action of the diaphragm, or straining, the patient is desired to keep his mouth open. Then, whilst with one hand the surgeon presses the swelling from below upwards, he, with the fingers of his other hand, regulates the direction of the pressure at the neck of the swelling; prevents the protrusion from overlapping the margins of the opening and being pressed against them, and guides it backwards into the cavity. In many cases the protrusion recedes, the moment the patient lies down.

Reduction having been accomplished, we then take measures to retain the viscera within the abdominal cavity. This is effected by means of pressure accurately applied over the aperture through which the hernia had descended. As such pressure requires to be maintained, it can only be done effectually by means of special apparatus, termed trusses; but, in the first instance, until a truss be fitted, we may use a compress, supported by a broad spica bandage, to prevent the protrusion returning.

The proper application of a truss, and the form of truss best adapted for each case, are very important considerations, and the surgeon should be thoroughly conversant with the different forms of trusses and the principles on which they should be fitted, and also be able to take the proper measurements, and give general directions when the apparatus has to be obtained from a distance. It is impossible to do more than throw out some hints as to these points. The form of truss to be used will depend on the special kind of hernia, and the conditions present in different patients. In many cases the ordinary spring truss answers sufficiently well, if properly fitted and adjusted, and in some instances it is more effective than any other, whilst its price renders it more within the means of the poorer classes, in whom hernia is very common. But it has some disadvantages. It is liable to shift, owing to the movements of the patient; or, if the spring is sufficiently strong to prevent that, the pressure exerted by it cannot be easily borne. If it is selected for a case of inguinal hernia, care should be taken that the pad, whilst sufficiently large to diffuse the pressure, should not be so long as to rest on the spine of the pubis, as that tends to prevent the truss pressing on the position of the deep ring and canal, where the compression is chiefly wanted. Pressure over the external ring merely prevents the rupture passing into the scrotum. The form of truss I used to recommend in general was what is termed "the opposite-sided truss," or "Salmon and Ody's truss." In this apparatus the spring passes from the centre of the back of the patient round the side opposite to that on which the hernia is situated, thus the pressure of the pad is made obliquely from below upwards, so as to counteract directly the line in which the impulse of the descending protrusion is greatest. This form of truss is usually fitted with a ball-and-socket joint at the junction of the spring with the head or compress of the truss. Thus the apparatus is not displaced by the movements of the body, and the spring does not require to be so strong as in the common truss. At the same time, the pressure thus exerted is chiefly at one point—viz. the centre of the compress, and the hernia is apt to tilt up and escape

from under the margins of the compress. To prevent this, and to maintain the direction of the force, I very generally use a back-lever-spring added to the head. To some extent this interferes with the action of the ball-and-socket joint, but the accuracy with which the pressure is adapted more than compensates for that. In cases of femoral hernia the opposite-sided truss is decidedly preferable to any other, but the head should be formed to fit the triangular hollow of the groin, and its surface so shaped as to project deeply under the falciform edge as it were. The form of the head of Eagland's spiral truss, fitted to the opposite side spring, and secured by the back-lever pressure, answers best in such cases. In some patients I have found the use of a small piece of soft sponge, applied over the femoral ring, and supported by the truss, of service where great difficulty was experienced in retaining femoral rupture.

The form of truss which I now prefer to any other is the "bow truss," an American invention, I believe. The steel spring, in the form of a bow, as the name implies, is placed in front, and the hernial pad passes down from it over the course of the canal through which the hernia had descended, and commands the whole length of the canal. The American pad is too small, and does not diffuse the pressure. An oval pad like that of the "Moc Main" back-lever truss fitted to the bowspring answers better in cases of inguinal hernia. A soft leather strap forming the cord of the bow passes round the back, and can be relaxed or tightened at will. This truss certainly is the simplest and most easily worn of any I have tried, and has no tendency to shift if properly adjusted. As regards the pad in any truss for inguinal hernia, if it be felt to press injuriously on the cord, a space should be left for that structure as in the horse-shoe pad.

The following measurements should enable the instrument-maker to furnish the proper size. As an error of an inch may alter the whole proportion of the truss, it is necessary to give the full circumference of the body. Place the end of the measuring-tape over the lower hernial aperture, pass it slopingly upwards to about two inches below the crest of the ilium, across the back to the same point on the opposite side, and from that, sloping down again, to the opening. The measure in inches will give the size of the truss required. You must also state the kind of hernia, and the side on which it is situated.

Whilst in adults afflicted with hernia the use of the truss can only be considered as a palliative, in children a carefully-applied truss, worn continuously, very generally effects a radical cure, by retaining the protrusion and compressing the canal through which it had descended; for, as the abdominal cavity enlarges, and its parietes are developed, the obliquity of the canal increases, so that the tendency to hernia is checked by the altered relations of the openings, whilst at the same time the textures are condensed by the continued pressure. In applying trusses in children, the pads or compresses should be of a flattened form, and not conical, for the latter form has the tendency to keep open the aperture and prevent permanent closure. This error is often committed in fitting trusses for umbilical hernia in infants, in which it is not uncommon to find the truss fitted with a conical or button-shaped pad, with

the view of pressing into the aperture through which the rupture emerges. This may, no doubt, directly prevent the escape of the protrusion, but it also effectually maintains the aperture patent, and so prevents a radical cure.

Operations for effecting the radical cure of hernia, though connected with the treatment of reducible herniæ, will be better understood after considering the special herniæ, and the operative procedure in strangulated herniæ.

LECTURE CI.

IRREDUCIBLE HERNIA—Causes which lead to the Chronic Condition—General Symptoms and Treatment—Acute Incarceration, or Constriction and Strangulation—Explanation of the Mechanical Causes leading to Constriction—Pathological Changes, and the Symptoms which attend them—Taxis: Principles and Methods to be followed in using it—Cautions regarding it—Dangers of Delay when the Taxis fails, or in waiting for urgent symptoms to warrant the Operation—Causes of Death in twenty-six fatal cases.

IRREDUCIBLE HERNIÆ require to be subdivided according to the causes which oppose their reduction. Thus, a hernia may be irreducible owing to adhesions between the protruded portion of bowel or omentum and the hernial sac, which prevent the contents of the sac being returned into the abdomen. In such cases the changes have probably taken place slowly; and although the protrusion is so far fixed as to prevent its reduction, it is seldom so largely adherent as to prevent the portion of intestine being affected by the peristaltic motion of the bowels; and so its function, though perhaps somewhat impeded, is not interrupted, nor indeed materially affected. The patient may suffer occasionally from irritation in the hernia, flatulent distension and sluggish action of the bowels, but in general there are no marked symptoms connected with this state. The condition of the patient, however, is always extremely hazardous, as he is liable to inflammation, or strangulation of the protrusion, being induced by various causes, such as external injuries or disorder of his digestive organs.

Secondly, a hernia may be irreducible from some alteration in form and increased deposit of fat in a portion of protruded omentum which has been left unreduced for some time, and has become so altered in form or bulk as to be no longer capable of being returned through the opening by which it had descended. In this case, if the patient applies for surgical aid before adhesions take place, reduction may be gradually accomplished by using means for reducing the fatty textures, such as low diet, and perfect rest in the recumbent position, combined with cold and graduated pressure over the hernia. I have in several cases succeeded in returning such omental herniæ, sometimes after this treatment had been prolonged for three or four weeks, and in some cases after a longer probation.

Thirdly, a hernia may be irreducible owing to its great bulk, and the altered capacity of the abdominal cavity. In other words, the protruded viscera have been so long and gradually displaced from their original cavity, that they have formed a sort of new abdomen for them-

selves, whilst the abdominal cavity has accommodated itself to the remaining contents, and its parietes have contracted so as to diminish its capacity, and render it incapable of receiving its former contents. This condition is sometimes seen in large umbilical, ventral, scrotal, and even, though rarely, in femoral herniæ. The general symptoms induced by this state of matters are chiefly those of flatulent distension and occasional attacks of pain in the hernia from irritation of the bowels; but the condition has occurred so gradually that the patients have almost become habituated to occasional attacks, and seem to suffer little and think less about the hernia, until something leads to the more urgent symptoms of threatened strangulation. It is of great importance, however, that the surgeon should bear in mind the altered relations and capacity of the protruded viscera and the abdominal cavity, in reference to operations when required in such cases; for were he to make a very free incision, so as to lay open a large extent of the sac, his position might be very embarrassing. All he requires to do is to cut through the textures over the neck of the protrusion and divide the constriction at the neck of the sac, and return as much as he can of the contents, so as to relieve strangulation: he cannot expect to be able to return the whole when the abdomen is so altered in capacity in relation to the protrusion. In the general treatment of all irreducible herniæ the patient should be directed to wear a hollow truss to protect the hernia, and prevent further protrusion occurring, and gradually to repress the existing protrusion. The patient should also be cautioned to take special care to regulate the action of the bowels, and avoid all sources of irritation of the digestive organs.

The foregoing examples of irreducible herniæ are not necessarily attended with any immediate dangers, although all of them render the life of the patient precarious. But when a hernia becomes irreducible from acute constriction, incarceration, or strangulation, the case is very different. Then the danger is imminent, and the symptoms soon denote the urgency of the case. Such acute incarceration and strangulation depend on constriction of the protrusion, leading at first to interrupted function in the protruded intestine, followed by peritonitis, and more or less rapidly by mortification of the protruded parts, the result of complete strangulation. The term INCARCERATION in hernia is used by some authors to include herniæ imprisoned by adhesions or altered bulk from chronic changes; I therefore think it better to use the term constricted hernia to denote the early stage of constriction before complete strangulation takes place.

There is perhaps no disease in which it is more necessary for the surgeon to have clear ideas as to the exact conditions with which he has to deal than in acutely-constricted or strangulated hernia. The very term constriction, though proper when correctly understood, is apt to mislead, by giving the idea that some active contraction of the apertures or structure, through which the protrusion emerges, has taken place. We have seen that the openings through which herniæ pass are formed in fascial or aponeurotic structures. It is at these apertures, or at the contracted portion of the sac, or in the resistant condensed fibro-cellular substance, external to and around the neck of the sac, that the

cause of constriction exists. The muscular textures crossing over the protrusion may compress it and oppose its reduction to some degree, and favour congestion in it; but they can never absolutely constrict it; and besides, by various methods, we can obviate muscular contraction; but, I repeat, it is in the aponeurotic and condensed fibro-cellular structures that the resistant cause of constriction is to be found. In one instance, indeed, I found the cause of constriction in a vessel circling round the neck of the protruded intestine; but the case is unique, and not to be included when considering the general causes of constriction.

Holding the views I have expressed, we get rid of the idea of contraction of muscles constricting the hernia, and look on such muscles as merely complicating the condition of incarceration or strangulation; and I now proceed to point out how the protrusion becomes constricted. In the majority of cases of hernia which become strangulated the protrusion has existed for some time previously, often for many years, and the openings through which the hernia descends are dilated, not contracted; and this condition, at first sight, seems difficult to reconcile with the idea of constriction. But the dilatation just amounts to this, that the thinner and less resisting margins of the apertures in the fascial textures have yielded to the gradual eccentric pressure of the hernial protrusion. These thin margins, so forced back, condense and render the denser structures more resistant, so that they oppose further dilatation—the circle of the opening offers passive resistance. If, under these circumstances, a fresh portion of intestine or omentum descends, and if the protruded gut become distended with feces or flatus, or the omentum become congested, there arises an altered proportion between the protrusion and the opening or canal through which it descended. The neck of the protrusion is distended and pressed against the resistant margins, and is indented by them. Then irritation of the gut and congestion from interrupted venous circulation follow, till increased congestion, swelling, and distension, terminate in complete strangulation. To make my meaning clear to a demonstration, I take this unyielding metallic ring, and I pass through it a loop of intestine. In its partially-distended state it can be easily pushed back through the ring, but I distend the gut by inflation. As I do so, you notice the altered proportion of the protruded part of the intestine. Still by a little management the gut can be reduced; but now I distend it fully. You see how the gut is indented by the resisting ring, and swells out over its margins, and can no longer be pushed back through it. This explains the nature of mechanical constriction in strangulated hernia. It is entirely passive as regards the hernial apertures, and depends on various conditions leading to distension or swelling of the contents of the hernial sac; and the thickened neck of the sac, as I have stated formerly, is very frequently the cause of this passive constriction.

The pathological changes and symptoms which follow the early stage of constriction, leading to strangulation, are first, irritation and swelling of the protruded gut. This is usually attended with some nausea and griving pains in the abdomen, and tenderness in the hernial protrusion. The peristaltic movements of the gut are interfered with,

and the return of venous blood is prevented, so that congestion ensues and gases become evolved in the gut; thus the hernia becomes more and more tense and distended, and more and more pressed out towards the resisting edges, so that these appear to cut into the hernia. It is important to remember these conditions while applying taxis. At this stage of incarceration certain symptoms are produced. The patient complains of pain in the part, from the gut coming in contact with the sharp edge of the fibrous texture, and owing to its distension. Some irritation is also produced in the part above the constriction. There is pain from the umbilicus towards the hernial protrusion, a feeling of nausea is set up, and the patient vomits, especially if the hernia has come down suddenly. Sometimes the irritation is communicated to the part of the bowel below the hernia, and causes a sudden attack of diarrhoea from the bowel below the constriction. The pain and distension become greater, the intestine becomes distended, so that the natural peristaltic movements of the bowel are arrested or inverted. The pain and tension in the tumour increase; the abdomen is tense, tender, and tympanitic, and the vomiting becomes more frequent. The pulse at this time is quick, the skin is hot and feverish, the tongue moist and loaded, and there is generally headache. In old people, or in chronic cases, the symptoms are not always so urgent. The vomiting may undergo marked remissions; it may be present at first, and then become less violent, so that we might think the patient somewhat better; but this often depends on the stomach being empty, and vomiting returns if liquid or solid food be taken.

Then the symptoms become more serious. The tumour becomes less painful perhaps, but the integuments covering it become of a dusky red hue; the abdomen becomes more tympanitic; the pulse small and irregular; and the vomiting changes in character. At first the matter vomited may be greenish in colour, but ultimately the contents of the gut are vomited, and—from the arrested peristaltic movements—fæculent vomiting takes place. The upper portion of the bowel is obstructed from the first.

Occasionally, when the portion of intestine which has been strangulated is very high up, we may have the appearance of bilious stools even when, in reality, strangulation is most complete; but this is not common. When the bowels have been emptied at first, we find that nothing more passes, for nothing can pass from above the constriction, unless in cases where only a portion of the canal of the gut is constricted (as in fig. 197). The skin gets cold and



Fig. 197.

Fig. 197.—Portion of bowel, not including its whole calibre, which was caught and strangulated at the crural aperture; the symptoms, though modified, proving fatal. During life, no tumour could be discovered at the site of protrusion.—LISTER. *His Elements*, p. 535.

clammy, the features become sharp; there is constant hiccup; and, unless relieved by operation, the patient dies from gangrene of the intestine, with all the symptoms of collapse. Before this takes place, however, the local symptoms are usually well marked. Emphysema takes place under the skin, the tension becomes diminished, and the tumour feels doughy or emphysematous. The bowel gives way into the sac, and unhealthy sero-purulent matter forms in the subcutaneous tissue over the hernia. These are the typical symptoms of a hernia passing from the state of acute incarceration to strangulation and gangrene. We may also have the violent and dangerous symptoms present from a portion of omentum becoming strangulated, though in such cases we may have the free movements of the bowels, as the bowel itself is not constricted. In some instances only a part of the intestine is nipped in the constriction, and then also the bowels may continue to act.

In old people the symptoms go on more slowly and insidiously. Often the pulse does not rise, and there is simply tension of the abdomen. The bowel is sometimes rapidly constricted, and the gangrene is confined to the portion protruded. Long before complete strangulation the constriction may lead to peritonitis, with pain and tympanitic tension of the abdomen, and pain on pressure. The peritonitis generally commences at the constricted portion, spreads along the peritoneal surface of the bowel, and then attacks the parietal peritoneum. This is a most dangerous condition, almost as much so as gangrene itself. Peritonitis is sometimes supposed to supervene in consequence of the operation, and I do not deny that it may; but I never yet saw a case of peritonitis in hernia where the peritonitis did not exist prior to the operation, as shown by the appearance of the bowel at the time of the operation.

We sometimes find a portion of the bowel which has been protruded retaining the indentation caused by the stricture, even after the constriction has been removed, thus causing intestinal obstruction, either complete or partial. Occasionally, the portion which has been constricted gives way some days after the operation, and then the symptoms are those of acute peritonitis rapidly supervening. This arises from ulceration of the mucous membrane of the bowel, the peritoneal coat only giving way at the last, and so perforation takes place, either by a large rent or numerous minute apertures. (Plate XXXV., figs. 2 and 3.) I have also known this to occur when the hernia had been reduced by taxis—in one case eight days after reduction.

It is most important, as I have already said, that you should fully understand the methods by which, and the principles on which, the surgeon interferes in cases of hernia, because promptitude in treatment is essential to a successful result. In a case of constricted or strangulated hernia, where it cannot be easily reduced, the surgeon must have recourse to active measures; and the first of these is the *Taxis*. Although, in the ordinary reduction, the manual pressure by which the hernia is returned may be called taxis, yet by that term we generally mean reduction by manipulation, where the hernia is not, as usual, reducible by the patient, and where a certain amount of constriction has occurred. The first thing to do is to ascertain whether the diffi-

culty in the reduction does not depend on the protrusion having been twisted upon itself, as very often happens in femoral hernia, where, from the way in which the hernia descends under the falciform edge, the body bends upon the neck, and tends to pass towards the abdomen. In such cases, therefore, we cannot press back the tumour directly, for then the pressure would not be in the axis of the opening through which the tumour has passed. Hence we must always attend to the position of the tumour, and its relations to the canal or opening through which it has passed.

Again, the tumour may yield to a certain extent in relation to the canal, but if it be very bulky, and if we press directly upwards or backwards, we press the mass of distended intestine and omentum over the margins of the opening, and thus create a difficulty. Hence attention to the position of the tumour, and the mode of dealing with the bulk which is protruded, are very important in attempting reduction. Often no difficulty occurs in reducing the bowel, if these little points be attended to. The difficulty, however, more generally occurs from a certain amount of incarceration and constriction being present, and a loss of proportion between the protruded parts and the opening through which they originally passed. In reducing such a hernia in the early stage, when the patient begins to feel a little nausea or vomiting, and pain in the tumour and abdomen, but without any great general distension of the abdomen, and where there is no reason to suppose there is any absolute strangulation, the first thing to do is to relax the parts, and place the patient in as favourable a position as possible for the taxis. Muscular fibres never form a complete constriction in hernia, but they may give rise to some congestion by pressing on the tumour, and hence we relax all muscular fibres as far as possible, by placing the patient in certain positions; so also with all tense fascial margins. Thus, in inguinal hernia, we generally bend the body forwards and raise the lower limbs, so as to relax the anterior abdominal muscles, and get over certain obstacles to the reduction. In femoral hernia again, we turn the thigh inwards, and flex it slightly upon the pelvis, so as to relax the falciform edge of the fascia. These are examples of the position in which the patient should be placed for the taxis. Formerly the warm bath, tobacco enemata, bleeding, and simple distending enemata, were used as adjuvants to the taxis. Now the only thing done is to give an enema to clear out the lower part of the bowel, and also to excite the peristaltic action of the intestine above, thereby giving a chance of the hernia being drawn backwards into the abdomen. The use of tobacco enema and bleeding are quite unnecessary since the introduction of chloroform, which is both a safer and more effectual relaxant of the muscles.

If it be true, as I believe, that the real constriction in hernia is always formed by aponeurotic or fascial texture, then we cannot expect very much good from relaxation of muscles in tightly-incarcerated herniæ; but we prevent the violent action of the diaphragm and of the abdominal muscles, while we also prevent the patient's straining against us. The enema should be given in very large quantity, to distend the lower portion of the intestines thoroughly and excite them

to peristaltic action. We should apply cold to the tumour, either by means of the ether spray or by ether dropped on the part, which should be fanned; or, what is still better, place some ice in a bag over the tumour for a short time. Cold should only be used in cases of recent hernia, and should not be continued long, and *never* when there is any suspicion of gangrene. The cold is beneficial in two ways; generally there have been attempts made both by the patient and by the surgeon to reduce the gut, and these give rise to a great deal of irritation and tenderness in the part, independently of the hernial symptoms, and the hernia itself is engorged from venous congestion. The cold relieves this local irritation and congestion, and causes contraction of the vessels. It also diminishes the distension of the gut itself, and by condensing the gaseous contents, lessens the bulk of the protruded mass. These are the means which I would advise you to use as auxiliaries to the taxis.

The patient should be put thoroughly under chloroform before the taxis is attempted. If the bowel is not so tightly constricted as to prevent its being returned by taxis, we will be able to reduce the hernia under these circumstances if the taxis be properly applied. In a case of femoral hernia, for example, we bring the hernia down to the axis of the canal through which it has passed; and now we must not press upwards, as that would only press the hernia upon the margins of the opening, but rather draw a little portion down, and then gradually try to pass the hernia back, bit by bit, into the abdomen. When once a small portion is got through the opening, the rest of the gut soon follows, with a peculiar gurgling sound. If we find that the taxis, properly applied, fails to reduce the hernia, then we should lose no time in operating, for I believe that any further persistent attempts at reduction by the taxis, owing to the manipulation, delay, and the risk of peritonitis, are much more dangerous than the operation itself. In many cases, if the hernia has only been down for twenty-four or thirty-six hours, and if the symptoms are not very marked, we can return the bowel by the extra-peritoneal operation, *i.e.* without dividing the sac of the hernia at all. Thus we only cut through skin and fasciæ, and this cannot cause any great risk; but in the taxis we cannot tell how the part is constricted—we may be pressing the distended intestine against the sharp margins of the ring, and so cause very serious lesion. Often on operating we find that the taxis has done harm. We must of course give the taxis a fair trial, but do not put off too long with it; there is no risk, I hold, in the operation itself, whether extra-peritoneal or by opening the peritoneum, if done early, and before changes in the constricted viscera have taken place.

I feel satisfied that in cases of constricted hernia the fatal results depend rather on the state of the parts prior to the operation, and on delay in operating, than on the operation itself, which involves scarcely any risk to life; and it should therefore be performed without undue delay, when it will probably be necessary at last. We are sometimes advised to wait until urgent symptoms come on, but this is very wrong. What is the use of waiting for the urgent symptoms? The very accession of these shows that the bowel has undergone changes which

will render the operation much less likely to be of use. Another point often insisted on is, that in small herniæ, such as the femoral variety, we must be quite sure we have to deal with a hernia. We are told sometimes it may be a gland, for there is no impulse in the tumour; but in a very tightly-strangulated hernia we cannot expect impulse, and this is only a greater reason for operating, as the part is so tightly constricted. I never yet felt any impulse in the tumour when the bowel was thoroughly strangulated; and the want of impulse is a sign that the bowel is completely and tightly strangulated. As regards the tumour being a gland, or a collection of matter, the diagnosis is to be found in the history and symptoms of the case. In doubtful cases, operate. If it be a gland or an abscess, an incision over the tumour will do no harm whatever; but if it should be a hernia, and if we delay the operation, waiting for urgent symptoms, we are risking the patient's life. I have repeatedly met with objections of the kind above alluded to, but I have always operated wherever there was the slightest doubt; and I have never yet operated without finding a hernia present; and this experience, conjoined with the great general principle, justifies me in strongly advising the operation.

Many years ago I looked over the results of 127 cases of hernia in which I had operated, and in these there were 26 deaths: in 17 out of the fatal cases the gut was distinctly gangrenous, and therefore, though the operation was the only chance of saving the patient's life, the state of the intestine was such that a favourable result could hardly be expected. In 7 cases peritonitis had commenced before the operation; and of these, 4 were cases of congenital hernia, where peritonitis occurs rapidly. In one case pyæmia proved fatal on the eighth day, but this case was a very complicated one. In one recent case, a fatal result occurred: here the operation was extra-peritoneal, and the hernia was very large and bulky, and had come down rather rapidly, while the patient was at his work. The man made violent efforts at the time to reduce the hernia, and afterwards attempts were also made, but without success. In this case the hernia had only been down for twelve hours. When I operated I divided the integument and the fascia down to the deep ring, and then, by dividing the textures external to the neck of the sac, I was able to reduce the hernia with great ease. After a time the patient began to pass bloody stools, showing that hæmorrhage from the interior of the gut had taken place, evidently in consequence of the efforts the man had made to reduce the hernia at first. I believe that if cold had been applied to the tumour, and the taxis properly employed at first, the hernia might have been reduced without any operation. The real cause of the fatal result was evidently the mischief produced by the violent and ill-directed efforts made by the patient to reduce the hernia when it first came down.

LECTURE CII.

Treatment of Hernia by Operation—Results—The Extra-Peritoneal Operation—The Ordinary Operation—After-Treatment: Local and General.

THE OPERATION for HERNIA consists essentially in the division of the constriction at the neck of the protrusion; but to reach this constriction we require to divide certain parts, which differ in the different herniæ. The great object is to expose the constricted part, and to divide it thoroughly and completely. To do this in all cases of herniæ, whether large or small, the incision should be made so as to give us plenty of room over the part corresponding to the neck of the sac, or where we expect to meet with the constriction. In inguinal hernia there is no use making an incision down the whole length of the scrotum; in fact this very often misleads. The incision should be made where we feel the neck of the hernia, and should extend above and beyond this so as to let us see the parts properly; and for this an incision two or three inches in length is quite sufficient. If we expose the parts too much, we are very apt to have a quantity of the intestine coming out of the incision. The incision should be no longer in a large than in a small hernia. We should aim at exposing the part where the constriction exists, and then we see exactly what textures we require to divide, for these are different in different herniæ, though the principle of the operation is the same in all cases. The constriction may be in the aponeurosis through which the hernia has passed out; or it may be in some condensed cellular tissue, external to the neck of the sac, for a few fibres will sometimes cause constriction; or it may be, and very generally is, in the sac itself. The constriction in old-standing and in congenital herniæ is almost invariably owing to thickening in the neck of the sac itself. This thickening takes place by deposition of lymph and condensed cellular texture from without, and the smooth surface of the peritoneum only becomes contracted towards the very last. In recent cases, by scraping rather than cutting on the constricted part, we can often readily reduce the hernia without opening the sac. This is called the extra-peritoneal method of operating.

The next thing to consider is the state of the bowel when exposed. If we have operated early and by the extra-peritoneal method, we do not see this; we simply return the contents of the sac into the abdomen, taking care not to push it up *en masse*. It is very important to remember this rule in small herniæ, for in them we might push the small knuckle of gut up within the abdominal parietes without relieving the

stricture, and this is more apt to occur if the sac be not opened. To avoid this, in the extra-peritoneal method, we must take care as to the mode of dividing the constriction. We see the constriction in the tightness existing round the swelling; we find the parts above and below distended, and when we scrape through the fibres causing the constriction, the indentation on the sac immediately becomes effaced, showing that the constriction is relieved, and that the contents of the upper portion of the bowel pass down to the portion in the sac. The protruded intestine can then be readily returned from the sac into the abdomen. We may then invaginate the sac, if it be small and loosely connected, and so get it out of the way of the pressure of the thick retaining pad. In inguinal hernia, however, we cannot generally do this.

When we require to examine the state of the bowel we must open the sac. This is an important point in the question between the extra-peritoneal and the ordinary operation in which the sac is opened. Why do we open the sac in any case when the bowel is to be returned? My answer to this is, that in many cases when I commence the operation I cannot be sure that the bowel is in a state to be returned. The extra-peritoneal operation is proper when the case is very recent, and when there is no reason to suspect any alteration in the structure of the bowel, and when there can be no hesitation in returning it. But if the hernia has been constricted for forty-eight hours, I would not feel justified in performing that operation, for in that time changes may have taken place in the bowel itself, and the very reduction of the affected bowel might prove fatal to the patient. The extreme advocates, however, of the extra-peritoneal method say that we try the taxis, and hence, say they, you would have been quite content to return the bowel by the taxis without seeing it, and why not after operation? But it is clear that if the taxis reduces the hernia, the parts have not been actually strangulated, while, if the taxis does not succeed, the probability is that strangulation has occurred; and if some time has elapsed during which the hernia has been down, the condition of the bowel may be such as to render it unwarrantable to reduce it into the abdomen. A doubt as to the fitness of the bowel for return is thus raised, and when there is any doubt I prefer to open the hernial sac and see the state of its contents.

We often find, when operating for hernia, that the moment the bowel is brought into view and the stricture divided, if we then try to push up the gut we succeed readily enough, and often without any harm resulting; but this is not very safe, for we should see the state of the bowel at the constricted part. We must not judge by what we see protruded below the constriction; we want to see the part which has been subjected to the greatest pressure, and that immediately above it, and also to make sure that we have thoroughly divided the stricture. I therefore gently draw down a portion of the bowel from above, which brings into view the part which has been subjected to the constriction, and from this part I judge whether to return the bowel or not, for this part may show symptoms of incipient gangrene, and if it were returned the results would be fatal. In cases where we open the

sac, we should therefore always examine the bowel in this way; and this also gets rid of the indentation of the gut, which sometimes remains for a length of time. It moreover shows us the state of the bowel above; and I think this is important, for I judge of the result of the case very much by the appearance of the bowel, above the constriction. If it be of the natural appearance, of a pinkish-gray colour, and smooth and glistening, even though the constriction has been tight, I generally augur well of the case, for this shows there is no general peritonitis, or if there be any, it is only in a very slight form; but if the bowel be granular and vascular, and covered by a sort of glistening fluid, or flaky lymph on its surface, even though the part of the bowel below be not much congested, then I consider the prognosis of the case to be unfavourable; the patient will probably die of intense peritonitis, for it is already existing before the operation.

In some cases we find the condition of the bowel rather doubtful; and in small herniæ this is very troublesome. We find a portion of the protruded gut dark, congested, and ecchymosed. I have even seen a portion of bowel quite black from ecchymosis caused by the taxis, and yet the patient recovered perfectly; but if the bowel be granular, and has lost its smooth appearance, or is soft like wet paper, the case is very doubtful; and then we generally find the constricted part deeply indented, and of a somewhat pale yellowish colour. If we see, moreover, that on the surface of the bowel there are points here and there of a grayish or white appearance, even though they are small, the risk is greater, for probably a slow form of gangrene is occurring, and this is showing itself by these points in the parts beyond the constriction. If the gangrenous or ash coloured spots be minute and not numerous, there is a chance of the patient's recovering without opening the gut; but if we find the gut perfectly gangrenous, and of a dark colour, we must not return the bowel. In such circumstances we are told to cut off the portion of gangrenous bowel, and allow the feces to be evacuated through the wound after the stricture has been divided. Such is the general practice, and so I used to do; but my own experience has altered my practice in this respect. Even when the bowel is distinctly gangrenous I do not cut off the gangrenous portion of gut at once, for I have seen that in many cases in which this was done, the patient, instead of experiencing any relief from the operation, died with intense suffering. When we cut off such a portion of bowel, and divide the constriction at the same time, as the patient is recumbent while a portion of the fluid feculent matter passes externally, part of it also passes back into the abdomen along with the external surface of the gut, and so more acute peritonitis is set up. I therefore divide the constriction freely, and draw down the gangrenous portion of the gut beyond the stricture, and leave it in the wound, merely covered by lint soaked in warm water. I give the patient an opiate after the operation, and then, some hours afterwards, I open the gut and cut out the gangrenous portion, so as to allow the feces to escape. By that time lymph has been effused around the protruded gut, and the risk of feculent fluid passing back into the abdomen is very much lessened. I have seen great benefit derived from this method in diminishing

pain by obviating acute peritonitis, even though it may not lessen the rest, ~~mortality~~ after the operation when the bowel is gangrenous. When the state of the bowel is doubtful, which is most frequently seen in femoral hernia, the plan I have adopted for many years to prevent effusion taking place into the abdomen is to draw the bowel down and examine it as usual, and then simply return it—not into the abdomen—but just within the ring, keeping the doubtful part of the gut opposite the wound, so that I can feel it readily; no dressings are applied on the wound beyond warm-water lint; the patient is placed in bed with the pelvis somewhat raised, so as not to allow the rest of the bowel to drag back the doubtful portion; but this is not very likely to occur, owing to the effusion of lymph which takes place.

In many of these cases it happens that perforation does take place afterwards; generally from the sixth to the eighth day after the operation. The patient is relieved from all the symptoms of strangulated hernia by the operation; opiates are given to check the action of the bowels at first, but in about a week a small quantity of thin feculent or bilious matter is discharged from the wound, and this gradually becomes more copious, showing that the bowel has given way. If effusion of feculent matter takes place, a fistula is formed, and no harm is done, as the parts heal and become adherent to the part corresponding to the opening in the bowel. If the bowel does not give way, the patient is no worse than in ordinary cases. In a case I had some years ago, the symptoms had existed for some time before the woman was brought into the hospital; the parts over the hernia were red and congested, and it looked like a gangrenous hernia; on examining the bowel I found it to present white points at one or two parts of the surface, and I therefore adopted the plan of treatment just described. The patient, instead of going on from bad to worse, as might have been expected—for peritonitis had set in before she was brought to the hospital—progressed very favourably, and the wound healed well; all the bad symptoms passed off, and no fistula formed. This, and many similar instances, satisfy me that, in cases where the bowel is at all doubtful-looking, the above plan of treatment is the best we can adopt. In cases where the bowel is decidedly gangrenous, I repeat that we should not cut it off at once, but divide the constriction, and wait till lymph is effused before we remove the gangrenous part, so as to prevent the feculent matter passing back into the cavity of the abdomen.

The after-treatment of cases of strangulated hernia, in which the condition of the bowel is such that we are justified in returning it after division of the constriction, is comparatively simple. Still there are some points of importance to be attended to as regards the principles on which it should be conducted.

At one time the general practice of surgeons was to give a purgative soon after the operation, so as to obtain a free evacuation of the bowels, and satisfy themselves that the operation was successful, as it was termed—that is, to make sure that the constriction was relieved. The effect of this violent action excited in the intestinal canal often injuriously affected the portion which had been strangulated, and set

up enteritis and peritonitis; and in the present day most surgeons are agreed as to the propriety of avoiding such stimulation of the intestine after operations for strangulated hernia. In my own practice, immediately after the operation I gave an opiate, to delay the peristaltic action as much as possible and keep the bowels quiet, so that the intestine may not be irritated by the passage of the feculent matter. The opiate also allays the vomiting and irritation which are present. After thirty-six or forty-eight hours, we may give an enema to stimulate the peristaltic action of the bowel. In general, however, if there has been any great distension of the intestine, the bowels will usually act after the operation without any purgative. When the bowels are long of acting, as sometimes happens in old people, we should give some gentle laxative. The local treatment is very simple. The wound is to be dressed like an ordinary wound, and a compress, supported by a spica bandage, is applied over the opening to prevent the hernia descending. The wound seldom heals entirely by the first intention, but the greater part of it heals pretty quickly; and after six weeks or two months we may fit on a truss.

In cases where, from the previous symptoms and from the appearance of the intestine as seen during the operation, it is evident that peritonitis has set in, the use of calomel and opium, in the proportion of half-a-grain of the latter to two grains of the former, should be begun at once, and the dose repeated every four or six hours, till some slight effect is produced on the mouth; or, in some cases, opium may be given alone, at intervals, with good effect. If the patient be young and robust leeches may be applied over the abdomen. In all cases the application of a blister over the epigastrium, or over the whole abdomen, with the exception of the part near the wound, is advisable, and it is much more generally applicable, and productive of more benefit than leeches. Emetics, or the simple Galbanum pill, may be used to relieve the tympanitic condition of the bowels; but no active purgatives should be given. Under this treatment I have seen several severe cases of peritonitis recover; but in general the diseased action has existed and spread extensively before the performance of the operation, and then the case is very hopeless.

The treatment of the large masses of omentum sometimes found in operating for strangulated hernia, especially in old large herniæ, requires some consideration. In many instances, after division of the constriction and reduction of the intestine, we find that the omentum left in the sac is very bulky, and partially or largely adherent to the sac, or large portions of it are nodulated and altered in form and consistence.

The reduction of a very large mass of omentum, even supposing no adhesions or alteration in structure have occurred, is always attended with the risk of exciting peritonitis, owing to the manipulations required; for it does not glide back like the intestine. Every portion requires to be guided and pressed back, and when it has suffered from strangulation its vessels are congested, and then portions of the serous texture are liable to be lacerated by the manipulations necessary to return it. In other cases, when adherent, or when altered in structure,

forming as it often does a large pedunculated mass, the difficulties and dangers are increased.

Under these circumstances, the question arises whether there is less danger incurred by removing the protruded mass or by using efforts to reduce it. If the portion of omentum be not very large, non-adherent, and presents a healthy appearance, the proper treatment is to enlarge the incision of the constriction freely, and gradually reduce the mass, keeping the sac intervening between the omentum and the fingers. If the protruded omentum be of moderate bulk, and only partially adherent to the sac, divide the adhesion, taking care to twist or tie any small vessel that may ooze, and then proceed as in the former case. In cases where the omentum is very bulky and loaded with fat, or consolidated and altered in form, so that the incision of the abdominal parietes would require to be very large to enable us to return it, and even then only with considerable manipulation and probable irritation or laceration, the safest plan is to remove it. The neck of the mass is firmly grasped by the assistant, and transfixed with a needle armed with cat-gut ligature, the loop of the ligature divided, and each portion of the neck of the mass firmly constricted, and the protruded omentum cut off below the ligatures, which are then cut short, and the upper portion of the omentum reduced. Or, the neck of the omental protrusion being firmly grasped, the surgeon cuts away the bulky portion, and ties each bleeding point separately. I have treated such cases very frequently in both ways, and cannot say I have ever seen any had results fairly referable to the section, whether the ligatures were applied by tying the vessels individually, or simply by constricting the neck of the protrusion as described. If the omentum, even when not bulky, presents any doubtful appearance of commencing gangrene, there should be no hesitation as to its removal, as the fat with which it is loaded has but little vitality, and is not likely to recover when reduced.

The local after-treatment of gangrenous hernia, in which a portion of the gut has been cut away, consists in applying a fold of carbolised lint, soaked in warm water and covered with gutta-percha tissue, over the wound; favouring the escape of the fæculent discharge; and paying great attention to cleanliness. There is at first a fulness of the mucous surface of the intestine, causing it to project (plate XXXV., fig. 1), so that it forms an obstacle to the passage of the fæces, and there is also a loss of tone in the intestines, so that they cannot propel their contents as usual; hence the surgeon often requires to introduce his finger, or inject some tepid water, to help the fæces to pass away. This distended and convoluted state of the bowel is one which is very common, and which is often fatal in peritonitis, even where there is no gangrene, from the obstruction it gives rise to.

Supposing, however, the patient to go on well, we require to consider the question how the artificial anus which results is to be cured. The two portions of intestine connected to the mesentery at the root of the loop of the protrusion lie at first parallel to each other, and the contents of the bowel pass completely from the orifice of the upper portion through the opening. The lower part has a tendency to become contracted, for there is nothing passing through it. After a time, how-

ever, owing to the contraction of the mesentery, from the effusion of lymph and the healing process, we find that the two portions of the bowel gradually tend to approach each other, and come to an angle as it were; the orifices thus approach nearer the axis of the line of the gut, and what the surgeon has to do is to take advantage of this natural process, and assist it to a certain extent. After a time, as I have said, the portions of bowel tend to become more in a line, but still the passage of fæces prevents closure of the intestine, and the septum will continue to act as a valve, and a fæculent fistula will be established. Sometimes nature will cure the fistula, but the surgeon occasionally requires to use compressing forceps to efface the septum and establish the continuity of the canal of the bowel. The blades of the forceps are introduced separately into the two portions of the bowel, and they are very gradually closed upon the projecting septum, so as to compress it. If this be done too tightly at first, violent irritation may follow, and hence great care is required in watching the patient after the first application of the forceps. They are kept on for some time, and gradually the valvular projection of the septum is effaced, and the continuity of the bowel is re-established; the fæces pass along the track of the bowel, and the natural channel is restored, while the fistula gradually heals. In less extensive gangrene of the bowel, treated by the method I recommended when speaking of the slightly gangrenous or doubtful state of the gut, when a fistula does take place we do not require this treatment, for in such cases there is only one opening; the continuity of the bowel is complete from the first; the parts become adherent to the integument, and the opening contracts and heals up.

LECTURE CIII.

Complications met with in cases of Hernia before and after Reduction: 1st. Old Irreducible Herniæ with Symptoms of Constriction; 2d. Herniæ reduced "*en masse*" by Taxis, and Symptoms of Constriction observed—Illustrative Cases—Precautions in operating which they suggest—Special Herniæ, and their Treatment—Inguinal Herniæ: Direct and Oblique—Differential Diagnosis.

I HAVE now brought under your notice the usual pathological conditions in cases of hernia, and the general principles on which the treatment of these conditions should be conducted; but before proceeding to the consideration of special herniæ, I must refer briefly to some complications, occasionally met with, which may render our diagnosis as to strangulation of the protrusion, and consequently our decision as to the line of practice to be adopted, more difficult. Some of the conditions which may cause doubt as to the nature of a swelling occupying the position of a hernia, such as hydrocele of the cord in inguinal, and enlarged glands in femoral hernia, I have already alluded to, and they will require to be noticed when speaking of special herniæ. At present I shall confine myself to noticing two conditions—1st. Cases of old irreducible hernia, in which symptoms usually indicative of strangulation occur. 2d. Cases in which symptoms of strangulation continue, after a hernia seems to have been fairly reduced by taxis.

The former condition is that in which there is most difficulty in deciding as to the symptoms depending on strangulation. One of the conditions which enables the surgeon to decide and act promptly, by operating early, in an ordinary case of strangulated hernia, is, that hitherto the rupture had always been reducible by taxis, but has become suddenly irreducible, and is accompanied by symptoms more or less urgent. This can only be accounted for by constriction of the protrusion; and the surgeon proceeds on that ground. In the class of cases I am now speaking of, this element, so important to correct diagnosis, is wanting. The protrusion has in these cases been irreducible probably for years, owing to adhesions, or some other cause; and whilst the symptoms present may depend on strangulation from fresh accession to the protrusion, or from congestion and engorgement of the old protrusion, they may also depend upon mere irritation of the intestine or omentum contained in irreducible hernia, for the protruded parts are quite as liable as other portions of the viscera to be affected by various sources of irritation. The tumour is more tense than usual, tender to the touch, and there may be vomiting and constipation, and

yet the hernia may not be strangulated; and having been long irreducible and fixed there, you cannot hope to reduce it now.

I recollect many years ago being called to see an elderly woman, a servant, who was labouring under very urgent symptoms—vomiting, tension of the swelling (an old irreducible femoral hernia), and tenderness of the abdomen. Enemata and other means had been used before I saw her, and medicine given by the mouth, but without affecting the bowels. I tried gentle pressure to the swelling, after having applied ice for some time, in hopes that I might reduce any new descent which might have occurred, but without effect. I then advised her to submit to the operation, but she refused, and stated as her reason that she had formerly had a similar attack, and that Mr. Liston had insisted on operating, but she had refused, and got better. I ordered her an opiate to relieve the pain and vomiting, but told her friends to send for me if the symptoms continued, and left her with forebodings of a bad result. Next day, when I went to see her, I found her almost quite well, and then I was informed that there had been a party in her master's house, and that she had tasted a variety of articles, and so set up the irritation in the hernia. Still, I consider, I would have been fully warranted in operating under the circumstances in which I first saw her. In several very similar cases which I have met with I have had to operate, and in all of them there was tight strangulation, so that had I trusted to my experience of the exceptional case above narrated, these others would have been lost.

Three years ago a man was admitted into the Royal Infirmary, under my care, suffering from an irreducible omental scrotal hernia. By applying cold, moderate pressure, and enjoining absolute rest and low diet, I was able to return a considerable portion of the omentum, and he was dismissed relieved. About ten months afterwards he was again brought from a long distance to my care, suffering from symptoms of strangulation and peritonitis. The surgeon who had seen him had wished to operate and urged him to submit, but, remembering his former recovery, he refused, and insisted on being brought to me. There was evidently a portion of bowel as well as omentum in the sac, and I told him there was no chance but by operating. I did so, and found the gut almost gangrenous, and he died in about forty-eight hours. This case, in contrast with the first mentioned, will show you the difficulty of being absolutely certain as to the cause of the symptoms arising in patients afflicted with irreducible hernia; but I would advise you that, though there may be some doubt, whenever the symptoms are severe, or do not speedily yield to opiates, and cold to the tumour and other remedies, the safety of the patient is in operating. There used to be a good old general order in the British navy, issued to all commanders, as regarded the propriety of engaging an enemy of superior force, "When in doubt, *fight*;" and in regard to hernia I would say, "When in doubt, *operate*."

The second class of cases I have referred to are those in which a hernia has apparently been reduced by taxis, and yet the symptoms of strangulation continue. When this occurs in the case of small herniæ, we at once conclude that the sac and its contents have been returned

en bloc with the constriction remaining on the contained gut. But in cases of large scrotal hernia, for example, you might question the possibility of this occurring, and yet I have met with several instances. In these large herniæ we have seen that an old small sac, with its constricted neck, may be pushed down before a fresh protrusion. In such cases the neck of the upper sac is wide enough to permit reduction of the mass of the hernia; but a small portion of gut has got into the old small sac and become strangulated; and this has been returned *en bloc*. Such has been the condition I have found in the cases I have had to deal with; the history of one of these will be found at page 1043 amongst the Clinical Cases. In such cases there should be no hesitation as to the line of practice; the continuance of the symptoms are our warrant for operating. Though perhaps fairly reduced within the upper ring, the hernia cannot be far removed from the opening; and by freely opening up the textures in the line of the canal through which it protruded, the surgeon is sure to find the strangulated mass, and can easily relieve it.

The sketch, plate XXXV., fig. 1, was taken from the case of a patient who was sent to my care from the country. Three days previous to his admission into hospital a large scrotal hernia had come down, and he was unable to return it as he usually did. Symptoms supervened, and he sent for a surgeon, who, with some difficulty, reduced it; as, however, the symptoms increased, he sent again on the second day for the surgeon; nothing like a swelling could be felt, but suspecting the real state of matters he sent the patient to me. On the most careful examination I could detect no swelling, though from the dilated condition of the inguinal canal I could easily pass my finger up throughout its whole extent; but I noticed, when he coughed, there was not the slightest tendency to descent of the rupture, and there was an indistinct feeling of some firm substance impelled against the finger. The man was evidently in a very dangerous state, almost in collapse, with constant hiccough and occasional vomiting. I laid the inguinal canal freely open, and divided the margins of the external oblique and transversalis muscles, to give me a full view of the parts. On doing this, and introducing my finger upwards, I felt a hard mass about the size of a small walnut, which was easily brought down into the wound, and proved to be a small subdivision of the hernial sac. This contained nearly four inches of intestine, not distended, but closely packed and tightly strangulated. On dividing the constriction I found the gut quite gangrenous, and on drawing down the portion of intestine continuous with it, I found that the gangrenous condition had extended for upwards of twelve inches. The gangrenous portion was cut away, and the ends of the bowel stitched to the integument to prevent retraction, as no adhesions had occurred. The appearance of the parts is shown in the sketch. The man rallied, and for some time seemed to improve, but the portion of gut strangulated had been high up in the jejunum, and he ultimately sank.

On the same evening that I operated on this patient, another man with a moderate-sized inguinal rupture was sent to my care. After cold had been applied I reduced it without any great difficulty, and

without giving chloroform. I applied a compress and bandage and sent him to bed, expecting that he would be quite well next day. Next morning, however, I found he had been vomiting almost constantly, and complained of pain in the abdomen, near the site of the deep ring; he had also a quick pulse and anxious expression. No vestige of swelling could be seen or felt, but he complained of extreme tenderness at the point mentioned. His bowels had not been opened since the rupture first came down. From the ease with which I had reduced the hernia, and the sensation of its return, I could not believe any portion was strangulated; but the urgency of the symptoms and the coincidence of the former case which I had just operated on, decided me on cutting down and examining the canal. I did so; but no protrusion appeared, nor could I feel any, though I slit up the parietes freely to make quite sure. But whilst the state of the patient, prior to the operation, was such as to indicate extreme danger, yet from the time of its performance all the dangerous symptoms disappeared. The intense pain and vomiting ceased immediately. The bowels were moved naturally the next day, and he made a rapid recovery. The results of these two cases, occurring as they did, formed a strong contrast, and warrant me, I think, in saying that safety lies in operating; and that, even though nothing be found, the patient is certainly not placed in greater danger. I can hardly help thinking that in the second case some small portion of gut must have been reduced during the manipulations, without having been noticed, the relief was so immediate and complete.

The urgent necessity for early operative interference in these cases cannot be too much insisted on, and recently the mesial abdominal section has been proposed on the ground of doubtful diagnosis.

It has been said that after a hernia has been reduced and symptoms of obstruction continue, doubts may arise as to whether the symptoms may not depend on some internal strangulation or volvulus coincident with the presence of a reducible hernia, and that in such cases mesial incision would be the best method of procedure. But my experience in such cases leads me to consider the proposal as a very dangerous one, and if I can show from a consideration of the relations and state of parts, and from what I have observed of the symptoms and conditions of herniæ reduced *en bloc* on which I have operated, that the diagnosis is not so difficult as seems to be supposed, then the indication for the performance of the old or direct method in preference to mesial incision in herniæ reduced *en bloc* will become evident.

As regards the state and relation of parts in a hernia reduced *en bloc*. If we consider the way in which the sac is formed by the parietal peritoneum, it is obvious, first, that when a portion of gut constricted by the neck of the sac, or by the condensed tissue around the neck of the sac, is pushed back from the canal through which it had protruded, the mass must lie between the parietal peritoneum and the abdominal parietes in close proximity to the upper part of that canal. In some cases the fundus of the sac may not be pushed quite out of the canal. In those cases, however, in which no tumour can be felt, the constricted hernia has been pushed fairly through the

upper opening of the canal, and lies between the fascia transversalis and peritoneum, with the body of the sac pressed aside, more or less bent upon its neck, and no longer corresponding to the axis of the deep ring or course of the canal, through which it formerly protruded. In the second place, it is impossible that the constricted mass can ever be pushed within the peritoneal cavity, because that could only be effected by invaginating the sac, and in doing that its contents must be everted and so relieved from constriction.

It is not difficult to understand how small herniæ, such as femoral, may be pushed up through the short canal within the abdominal parietes. The cases likely to give rise to doubt are cases of large inguino-scrotal hernia, in which the rupture has been reduced with some difficulty, perhaps, but with distinct sense of "gurgling."



Fig. 188.

It may at first seem difficult to conceive of such a large hernial protrusion being pushed back constricted. The condition of the hernia in these cases requires explanation, as it is one not much alluded to in surgical works. It is one to which I drew attention in reference to a case of strangulated scrotal hernia on which I operated in 1840.¹ The peculiarity consists of the division of the sac into two cavities, a large upper part and a small lower compartment, with a narrow thickened orifice or canal of communication between them. In such cases the strangulation is at the constricted neck of what I may call the lower and smaller sac. Hence, whilst the contents of the larger sac are reduced with the sense of gurgling, it acts as a dilator, the small constricted mass follows and is pushed up within the parietes, still constricted.

Keeping in mind the relations and state of parts in herniæ reduced *en bloc*, I proceed now to connect them with certain symptoms which I consider characteristic of that accident which distinguish it from other causes of obstruction, such as internal strangulation and volvulus coincident with a reducible hernia.

In all cases of hernia reduced *en bloc*, we have the history of the presence of a hernial protrusion in the first instance accompanied by incipient symptoms of constriction. The apparent reduction of the protrusion with more or less difficulty, the continuance and gradual aggravation of the symptoms of obstruction, occasionally, perhaps, some slight remission of more urgent symptoms, but never any real relief. If the protrusion has been fairly pushed up within the parietes, then no tumour can be felt. Even in cases of large scrotal herniæ so reduced *en masse*, in which the dilated and now empty canal permits the finger or fingers to be easily passed up throughout its whole extent, nothing can be felt beyond a dull impulse on coughing.

There may be a greater degree of dullness on percussion and tenderness over the part of the abdomen corresponding to the deep ring, and above it, than elsewhere, if we have an opportunity of examining the

¹ See case of P. B., Clinical Cases.

patient soon after the mass has been reduced. But most usually when the surgeon is consulted the general tenderness and tension of the abdomen render these symptoms indistinct.

The condition or symptom on which, from experience and from consideration of the state of parts, I rely as diagnostic, is, that when the constricted protrusion has been pushed up from the canal completely within the parietes, no effort of coughing or action of the abdominal muscles can make the hernial swelling reappear. This I consider to be quite characteristic of the true nature of the case as distinguished either from a constricted hernia partially reduced from the canal, or from an internal strangulation coincident with a reducible hernia.

In the former case the patient may, by forcible effort of coughing, or by being made to sneeze, cause the hernia to descend, and then it comes down with a "bolt" *en masse*, and leaves little doubt as to the mode of treatment. In such a case, the fundus of the hernial tumour has still occupied the upper opening of the canal, and its body still corresponded to the axis of the canal, and so there is nothing to prevent a certain degree or kind of force causing it to descend as I have described. In the case of a protrusion reduced *en bloc* within the parietes, it no longer corresponds to the opening or course of the canal. It is pressed aside, with the body flexed on the neck of the sac, out of the line of the canal from which it has been pushed, and therefore cannot be made to reappear.

In the case where the obstruction depends on the existence of an internal strangulation coincident with a reducible hernia, when the hernia is reduced there will be no difficulty in causing it to reappear, rather, on the contrary, there will be difficulty in retaining the hernial protrusion in consequence of the abdominal tension causing the free intestine to escape. This is what we see in cases of double hernia, when one of them becomes strangulated. Both herniæ are tense, the unconstricted one is reduced with some difficulty, and when reduced has a constant tendency to protrude, until the abdominal tension is removed by relieving the constriction on the strangulated hernia. I think it will be admitted that the conditions leading to the symptoms in both cases are, if not identical, strictly analogous. From what I have stated regarding the condition of parts, and from what I have observed in cases in which I have been consulted, and on which I have operated, I feel satisfied that there should be little difficulty in arriving at a decided diagnosis between an internal strangulation and a hernia reduced *en bloc*.

As to treatment, the sooner operative measures are resorted to the better, and as to the method of operating, I feel satisfied that the old or direct method is better suited for cases of hernia reduced *en bloc* than the mesial incision. Let us briefly consider the advantages and disadvantages of each method. In the direct method, by incising in the line of, and laying freely open, the canal through which the hernia formerly protruded, we are certain of finding the constricted hernia as it is fixed by its connection with the peritoneum, and if the incisions be properly planned, we generally find it easily, and can readily bring

it "down into the canal." Then we deal with it as in an ordinary hernial operation,¹ opening the sac and examining its contents, to satisfy ourselves of their condition, and of the propriety of reducing them or otherwise. Next, by dividing the constriction to a moderate extent, we feel whether the gut is adherent, and if not, we can draw it gently down so as to see the part which has been more immediately under the constriction (for that is the point of danger), and judge of its condition and its fitness for reduction. And all this is done whilst the parts are, as it were, outside the abdominal cavity, and therefore with little or no risk of faecal extravasation.

Again, if, as is too generally the case in hernia reduced *en bloc*, we find the intestine gangrenous or parts of it in a doubtful state, we can deal with it much more satisfactorily than if we had opened the sac from within the abdomen, and had to deal with gangrenous gut in that cavity. It not unfrequently happens in hernial cases in which constriction has continued for some time, that changes have begun in the gut which was directly under constriction, sometimes pretty firm through recent adhesions, with softening of the gut in the immediate vicinity. In other cases the state of the strangulated intestine may be such as to render its reduction of doubtful propriety, even if not adherent. We know that though the peritoneal aspect of the intestine is not gangrenous, that the mucous membrane at the seat of constriction suffers at an earlier period, and is liable to ulcerate and lead to perforation, with its fatal consequences, if the doubtful portion of bowel has been returned within the abdominal cavity. In such cases the proper plan is to relieve constriction freely, but not to reduce the doubtful portion of bowel immediately. Here it is evident that we can examine and deal with the contents of the sac much more safely and satisfactorily, by what I call the direct method than by a mesial incision, by which we can only reach the strangulated intestine indirectly, and cannot see or judge of its state at or below the constriction until we have freed and brought it into the cavity of the abdomen.

The mesial incision in cases of strangulated hernia reduced *en bloc*, besides being more dangerous than the old or direct method, seems to me to present no advantage whatever, except to resolve a doubtful diagnosis, which, for the reasons I have adduced, I do not think should exist. Mesial incision or gastrotomy in cases of internal obstruction is certainly proper and much more frequently performed than formerly; but even in such cases its results are not specially brilliant, whilst all who have performed it know that it is often troublesome, complicated, and dangerous.

It is true that in many cases, by making a limited incision, and taking care never to allow any large portion of distended intestine to protrude, but examining and returning it bit by bit until we arrive at the point of obstruction, we may accomplish our object without much exposure or manipulation of the intestine. In other cases, how-

¹ In some cases of femoral hernia, owing to the loose connection of the peritoneum, the constricted mass is sometimes pushed back so as to lie partly within the brim of the true pelvis; but there is no real difficulty in finding and drawing it down, if the surgeon feels gently in different directions with his finger.

ever, as in some cases of volvulus, where the mass of intestines prevents us seeing and dealing with the obstructed portion, and in which the distended small intestines require to be for a time withdrawn from the abdominal cavity, or in cases where, in spite of our efforts to control them, the coils of distended intestines escape, we have in the mesial incision formidable sources of embarrassment to the surgeon and danger to the patient, from which the direct operation for herniæ reduced *en bloc* is free.

But suppose that in operating by the mesial incision on a case of hernia reduced *en bloc* the surgeon is readily guided by the distended intestine to the seat of strangulation. What then? He has reached it indirectly; he cannot see or examine it even imperfectly without exercising traction to bring it from the inguinal or inguino-femoral region towards the mesial line, and here begins one of its greatest risks. It is said that extrication of the constricted hernial protrusion can be more easily effected by traction from within than by pressure from without, as in taxis. That is true under certain conditions, as when the protrusion is recent and not very tightly constricted, as in the earlier stage of strangulation. Under these circumstances, I have already pointed out the value of exciting peristaltic movement of the intestine by enemata as an auxiliary to or to prepare for the taxis. It is on the same principle also that the old Indian method of reducing a hernia by means of a sheet or cloth passed across the abdomen and drawn from below upwards, whilst the patient is placed on an incline with the head down and the lower part of the body raised, is successful in aiding ordinary taxis. But in cases of herniæ reduced *en bloc* the conditions are different. The supposition that the rupture has been fairly reduced too generally leads to temporising treatment and loss of time before the danger is realised and the propriety of operative interference considered, and in the meantime the reduction *en masse* has intensified the constriction and aggravated the tendency to morbid alteration in structure. We have only to look at preparations from fatal cases of strangulated hernia to see what might often occur if traction were made from within to extricate the constricted intestine. In many cases the partially adherent and altered gut would give way at or above the seat of stricture, and its contents would be extravasated into the peritoneal cavity. Or if, as must frequently happen, the constriction be so tight as to require division by the knife from within, such a procedure would be attended with less safety and certainty as to the relation of the bloodvessels, but especially with greater risk of wounding the distended intestine below the constriction, as the surgeon could not push aside or guard it, as he does when he opens the sac and divides the stricture in the usual way from below upwards from without.

Then, in dealing with doubtful or partially gangrenous intestine, to which I have already alluded, we would be placed at great disadvantage in managing the intestine, whilst, if the state of the gut led to the formation of an artificial anus, the central abdominal region would certainly not be preferable to the groin.

Looking at the question from every point of view, I feel satisfied

that the ordinary direct method of operating in cases of strangulated hernia reduced *en bloc* is the proper procedure, founded on true principles, and decidedly preferable to mesial abdominal section.

I cannot too strongly urge the imperative need for watchfulness and early interference when symptoms of obstruction arise or continue after apparent reduction of a hernia. There should be as little palliative treatment by opiates as possible, for these mask the urgent symptoms, and so lead to fatal delay. For my own part, from what I have seen, I would say that if, under such circumstances, the protrusion formerly present could not be made to descend by any effort, then operative procedure is clearly indicated, and should be performed at once. In most cases it is only resorted to too late to save life.

In operating for strangulated hernia, as well as in reduction by taxis, a portion of gut may be pushed back with the constriction unrelieved. This is most likely to occur in operations for small herniæ, and especially when the extra-peritoneal operation is adopted, unless care be taken to empty the sac of its contents before invaginating it, and to avoid pushing a small rupture back *en masse*. In femoral hernia this might easily occur if the operation be roughly or carelessly performed. But even when the sac is opened this accident may take place. I have in my private museum a small inguinal hernia, from a case operated on by an excellent surgeon and anatomist, in which the gut has been pushed up within the parietes, with a tight strangulation at the neck of the sac still remaining unrelieved. I have, from the time I examined that case, invariably used the following precautions in all cases in which I find it necessary to open the sac:—First, after dividing the constriction, I draw down, very gently, a fresh portion of intestine, to feel that the gut is free, and to ascertain its condition at and above the constricted point. Secondly, in reducing it I follow the bowel or omentum with my finger, to make myself absolutely sure that it is fairly lodged within the peritoneal cavity, and that no constriction can remain. In operating by the extra-peritoneal method, I never return the sac and its contents simultaneously, but first empty the sac of its contents. If I find any difficulty in doing so, I open the sac, so as to avoid all risk, and to leave no doubt on my mind as to the state of the parts. For whilst in a recent case I see no reason for unnecessarily opening the sac, I have no such dread of the effects of opening it as to induce me to run any risk of an imperfect operation. The great safety in strangulated hernia is early operation, performed carefully and deliberately, making sure of free, or at least complete, division of the constriction, and avoiding, as far as possible, fingering the intestine, or using much pressure to return it into the abdomen. When much pressure is required, the constriction is not sufficiently divided, and unless it be more freely relieved, the tense bowel will suffer if it be forcibly returned.

The SPECIAL HERNIÆ most commonly met with in practice are *Inguinal*, *Femoral*, *Ventral*, and *Umbilical*. The other forms, *Vaginal*, *Obturator*, and *Diaphragmatic*, are very rare. I have seen a vaginal hernia, but I never met with an obturator hernia in the living. The

points in the abdominal parietes where herniæ protrude most frequently are the inguinal and femoral regions. The inguinal hernia is much more common in males than in females. I have not operated on more than four cases of strangulated inguinal hernia in women out of more than 200 cases, and these I did not meet with till I had operated on more than 100 cases. The reason of this is, that in the female the canal, only transmitting the round ligament, is very small, and can scarcely be said to exist; the walls of the canal are in close apposition, except where the small cord-like ligament passes down. Again, in the female the pelvis is very wide, and the space between the anterior superior spine of the ilium and the spine of the pubes being larger than in the male, there is a larger space between the vessels and the crescentic margin of Gimbernat's ligament, and therefore the weakest point in the female is in the femoral, whilst in the male it is in the inguinal region. At the same time femoral hernia is by no means uncommon in males, though not so common as inguinal hernia; but we require to operate very often for femoral in males, because it is more frequently irreducible from constriction than the inguinal. In the female, as I have said, an inguinal hernia is comparatively rare.

1. *Inguinal Herniæ* are divisible into two great forms, the *Oblique*, and the *Direct* or *Ventro-Inguinal*.

In an ordinary oblique inguinal hernia the protrusion passes down

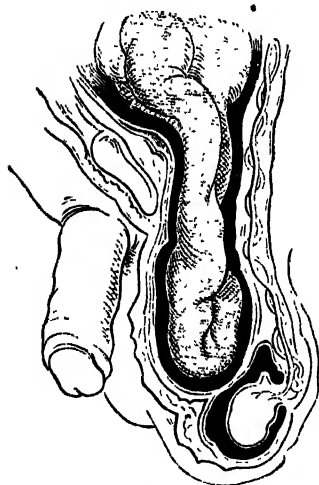


Fig. 199.

very nearly in the direction of the cord in the male and the round ligament in the female. If we trace it from within outwards, we find that it emerges, in the first instance, at what is termed the deep ring or opening in the fascia transversalis. The sac of the peritoneum, containing the protruded viscera, descends from within this, and as it passes down it is invested by a thin layer of condensed fibro-cellular tissue, which may be looked on as an offset of the fascia transversalis (*fascia spermatica interna*), continued along the cord from the margins of the deep ring or opening. That opening, however, presents distinct margins of a resistant and somewhat aponeurotic character; the hernia protrudes through this opening, the peritoneal sac being of course carried

before it, and forming a part of the protrusion. The protrusion passes down in front of the cord, insinuating itself between that structure and its different coverings as it passes down. In the first instance, therefore, it is covered by the *fascia spermatica interna*, or in surgical language, the *fascia propria*—the prolongation of the *fascia transversalis* already mentioned. It then proceeds down the canal for about half-an-inch, where the lower margin of the transversalis muscle crosses it,

Fig. 199. Relation of parts in an ordinary Scrotal Hernia.

next the lower margin of the internal oblique muscle also covers it in part, and just as it emerges from under the edge of that muscle in the male, it receives a series of fibres coming from the internal oblique—the cremasteric fibres. In a case of inguinal hernia the fibres of the cremaster are scattered and flattened out, mixed with condensed cellular tissue, and this has been termed the cremasteric fascia. The hernia then continues its course along the cord, and passes down, merely covered by the aponeurosis of the external oblique, till it arrives at the lower opening. At that point an inguinal hernia is generally prevented from passing lower down for a time, and merely bulges out, forming what used to be called a bubonocoele or proper inguinal, as distinguished from a scrotal hernia. From the margins of the external ring in the aponeurosis of the external oblique muscle it receives another covering, the fascia spermatica externa; and after this it is covered by the common superficial fascia and integument, and then passes down into the scrotum, receiving the different scrotal coverings. The protrusion of course lies in front of and covers the spermatic cord, and in an ordinary scrotal hernia the testicle can be felt below the protrusion at the bottom of the scrotum. On looking at a case of inguinal hernia, as the surgeon cuts down upon it, the coverings are, the skin, superficial fascia, the fascia spermatica externa, the intercolumnar fascia between the pillars of the external ring, the cremasteric fascia, the margins of the internal oblique

and transversalis muscles which cross and overlap it, and, lastly, the fascia propria immediately investing the sac. While it is well to study these anatomical points, that the surgeon cutting down on the hernia may recognise these parts, yet you must not expect to see them as in dissection. You should examine preparations of herniae, to recognise the morbid changes in structure in old herniae. It is wrong, however, to say, as some do, that a knowledge of anatomy is of no use in regard to operating for hernia, for it teaches us not only to recognise textures when operating, but also to understand the direction of the protrusion and its relations to other parts, and hence is useful in regard to diagnosis and treatment, whether the latter consists in the taxis or the operation.

We must now briefly consider the course of a *Direct* or *Vento-Inguinal* Hernia. This kind of hernia does not pass through the whole length of the canal; it emerges through some weak point in the con-

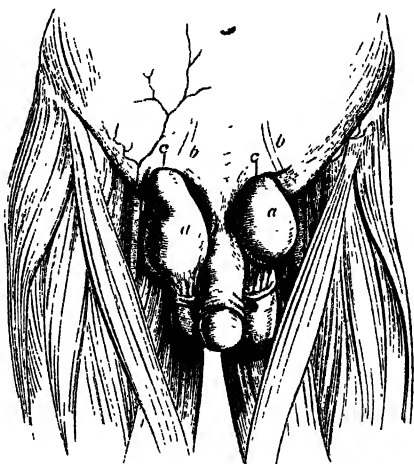


FIG. 200.

Fig. 200. Oblique Hernia on right side. Direct Hernia on left. *a*, hernial protrusion. *b*, epigastric artery. *c*, lines of incision in either form of Hernia.

joined tendons, from distension of the abdomen, or some other predisposing cause, leading to the formation of a weak point in these tendons. The hernia may either carry before it the fascia transversalis, or burst through it, as that fascia is very thin at this point. The protrusion therefore passes along only the lower part of the canal, and then directly downwards and forwards, so as to correspond at once to the lower or external ring. It very generally carries the thin almost cellular portion of the fascia transversalis before it. Camper, however, was of opinion that it always broke through the thin fascia transversalis, and hence he stated that the fascia propria of a direct inguinal hernia was different from that of an oblique, and was formed by the intercolumnar fascia, or the fascia spermatica externa, from the margins of the external ring.

The principal point of difference to consider is, that the direct or ventro-inguinal hernia protrudes on the inner side of the cord, and crosses and covers it at the lower part of the canal; whereas an oblique inguinal hernia follows the direction of the cord, and crosses over the course of the great epigastric artery (*b*), running from without inwards, so that the neck of the hernia (*a*), where it emerges from the deep opening, corresponds at its inner side to the artery, whilst in the direct inguinal hernia the artery lies to the outer side of the neck of the hernia. This used to be considered of great importance as regarded the operation. In oblique inguinal hernia the rule was to turn the edge of the knife obliquely upwards and outwards, so as to avoid the deep epigastric artery; whereas in a direct inguinal hernia, if we divide the stricture by cutting outwards, we would be almost sure to injure the artery, and therefore the surgeon was warned that he must be very careful in deciding whether the hernia was direct or oblique. Sir Astley Cooper showed that practically we only require to divide the few fibres forming the constriction; and if we carry the knife directly upwards parallel to the mesial line, so as to divide the constriction at its centre (*c*), there is no risk of wounding the artery whether the hernia be oblique or direct.

In regard to the DIAGNOSIS of inguinal hernia, I have already stated the absolute diagnostics of hernia, and these being kept in mind, I have now to bring before you what is sometimes termed the differential diagnosis, or the distinction between this form of hernia and other diseases occurring in the regions which it occupies. When the swelling is confined to the inguinal canal, the diseased conditions which are most likely to simulate hernia are hydrocele of the cord, cystic tumours, or fatty accumulations developed in the canal in front of the cord, or abscess over the cord. Encysted hydrocele of the cord at its upper part has a very close resemblance to a small inguinal hernia, but there is want of direct impulse, whilst we find irreducibility, tension, fluctuation, and dulness on percussion, without hernial symptoms; when the swelling is prominent, the light test for transparency can sometimes be applied. In most cases its defined form and position in relation to the cord, together with the history and irreducibility, leave little doubt. But if such a case becomes complicated, with symptoms of strangulation, there is no safe diagnostic, short of cutting down upon the tumour to make

sure ; for cases have occurred in which a small hernia had descended behind a hydrocele of the cord and become strangulated. Encysted tumours in the canal are rare, and when present their globular form and the cord being felt free above the cyst, the mobility of the cyst, its irreducibility and want of direct impulse, are generally sufficient to settle the question of diagnosis. Fatty masses in the canal are not very common, and when developed high up, so as to cover the cord in the whole length of the canal, they present very much the feeling and character of omental hernia ; indeed, it is almost impossible to distinguish them during life from small irreducible omental herniæ. Should symptoms of strangulation occur under these circumstances, and the surgeon cut down upon the swelling and encounter such a defined mass of fat, he must take care not to be thrown off his guard, but should slit up and examine the canal thoroughly, lest a small constricted rupture be also present. Abscesses, acute or chronic, sometimes occur in this region, and I have already spoken of these and their symptoms ; but I cannot say that I have ever seen any case where there was difficulty of distinguishing between such abscesses and hernia.

LECTURE CIV.

Differential Diagnosis of Hernia: *Continued* Diagnosis between Hernia and Inflammation of the descending Testicle in Children or Adolescents: between Hernia and Hydrocele, Hæmatocele, Cirsocoele, and Special Tumours of the Cord and Testis: Reduction of Oblique and Direct Inguinal Hernia by Taxis and by Operation in Adults and in Children—Modifications of Oblique Inguinal Hernia—Congenital—Infantile.

THERE is one condition likely to simulate an inguinal hernia in the canal, which I have purposely refrained from speaking of, that I might draw your attention specially to it, as I have seen errors of diagnosis occur which might have led to very serious risk. I allude to cases in young children or adolescents, in whom the testicle has not descended into the scrotum. In such instances, from injury or some indefinite source of irritation, it sometimes happens that the testicle inflames and swells, and becomes as it were compressed or almost strangulated by the dense structures bounding the canal. Under these circumstances there is a tense and excessively tender elongated swelling, occupying the canal and bulging the intercolumar fascia at the external ring; and along with these local conditions there are severe constitutional symptoms, vomiting, tenderness, and swelling of the abdomen, frequently constipation, and invariably a great amount of fever. The coincidence of such symptoms with a tense, tender, and irreducible swelling in the inguinal region, excite suspicion of strangulated hernia; and even when, from examination of the scrotum and the history of the patient, you arrive at the conclusion as to the true nature of the case, still you will often feel anxious lest there may possibly be some hernial complication; and this more especially if the bowels do not act under the effects of medicine. In such cases you must take into account all the circumstances. By applying cold over the swelling, or at a later stage by opiate fomentations and the administration of anodynes, the swelling and painful symptoms usually abate. If, however, the symptoms become aggravated, I can conceive of the necessity for the surgeon cutting down upon the swelling to ascertain whether it be a hernia; and in case it was not, it would be the proper treatment, as the testis would be relieved from compression or constriction, and by a little gentle traction it might be brought into the scrotum. In all the cases I have seen, however, the symptoms have passed off under rest and treatment, without necessitating such an operation.

The diseased conditions which may simulate an inguinal hernia when it has descended into the scrotum are, Hydrocele, Hæmatocoele, Cirsocele, and special tumours of the cord or testis. The distinguishing marks between hydrocele and hernia are the general form of the tumour and its relation to the cord and testis. In an ordinary scrotal hernia, the protrusion having descended in front of the cord from above, the whole extent of the cord is, as has been already stated, covered by the swelling, and the testicle can be felt at the bottom of the scrotum below the hernia (fig. 201). Now, in hydrocele, the cord can generally be felt free in the inguinal canal and at the external ring, whilst the testicle cannot in general be felt, as the sac of the tunica vaginalis is distended round it. Then the swelling in hydrocele has no distinct impulse imparted by the patient coughing; it has swollen gradually from below upward, there is dulness on percussion, and on examining it with the transmitted light of a taper it is generally transparent. In hæmatocoele the weight of the swelling, its dulness on percussion, and the relations to the cord and testicle, as in hydrocele, together with the history of the case, are in general sufficiently diagnostic. In most cases of cirsocele there is really little or no difficulty of diagnosis, the relations of the swollen veins to the testicle, the peculiar sensation on feeling the distended vessels, the way in which they can be emptied by pressure when the patient is recumbent, and the manner in which the swelling gradually returns when the patient is erect, even though the finger is pressed on the aperture, together with the worm like sensation the distended veins have, and the peculiar kind of impulse when the patient is made to cough, are usually sufficient to decide the surgeon as to the true nature of the case. At the same time, I have seen some few cases where, from enormous dilatation of the veins, and from serum apparently being effused amongst the constituent textures of the cord, the swelling in cirsocele has very closely simulated a scrotal hernia.

Tumours of the testicle can hardly simulate hernia, but some soft malignant tumours of the cord closely resemble it as to position and relation to the testicle; but then all the other symptoms are different, and the history of the case is usually quite sufficient to decide its true nature.

We now proceed to consider the method of returning an oblique inguinal hernia by Taxis or operation. The patient is placed recumbent, and with the shoulders and pelvis raised to relax the abdominal parietes. In this form of hernia the canal is oblique; and if taxis is to be applied here, let us see how it is to be done. It must of course be applied in the axis of the canal, *i.e.* obliquely, upwards and outwards, towards the anterior superior spine of the ilium, and the last part of the pressure must be applied directly from before backwards, when we have reached the upper opening. In applying the taxis we must bring down a little portion of the bowel, as before mentioned, to try and free it from the constriction. The obstacles to the reduction of this form of hernia by taxis are the margins of the external ring, which do not in general, however, form any very great obstacle: then there are the muscles

covering the hernia, which should be relaxed: although they do not absolutely constrict the protrusion, yet they oppose reduction. It is at the deep ring and at the neck of the sac that the resistance is greatest; but it is only when there is incarceration that there is any difficulty, for in most cases of inguinal hernia we can put two or three fingers into the opening, and therefore the taxis is not generally very difficult.

In children the canal is not oblique, and the two openings lie nearly opposite each other. It is only as development proceeds that the canal becomes oblique. We must remember this as regards the diagnosis of a direct from an oblique hernia, and also as regards the use of a truss in a child. By using a truss at an early period in a child, as I have already stated, we often effect a radical cure; so that when the child grows up the truss may be left off altogether. Even in the adult, in many cases, the canal looks almost direct; and it used formerly to be considered of great importance to distinguish a direct from an oblique inguinal hernia. In probably nine out of ten cases an inguinal hernia is oblique, but the hernia presses inwards towards the inner margin of the ring, and dilates it, so that it comes nearly opposite to and in a line with the superficial or external ring, and it looks very direct; but this is merely from the great dilatation of the deep ring.

In the OPERATION for inguinal herniæ the line of incision is much

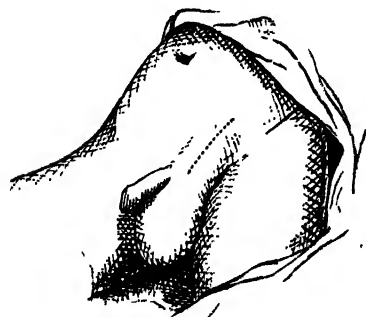


Fig. 201.

the same in either case, whether it be oblique or direct. Commence the incision well over the neck of the sac, corresponding to a point above where you notice the projection, because you want to expose and see clearly the parts at and above the neck. The length of the incision should be from two and a half to three inches. Even in a large scrotal hernia the incision should not be longer. You only want to make the incision through the textures over the canal. Beginning

then, above the neck of the hernia, you cut through the skin and superficial fascia with one incision. I generally make this first incision from within outwards, by pinching up a transverse fold of the integuments and loose textures from over the protrusion, and transfixing it with the bistoury, the back of the knife being towards the hernia. I then cut out, dividing the fold, and extend the incision upwards and downwards, if necessary. In cases of gangrenous herniæ, or in those where, from inflammatory action, the superficial parts are matted together, the method just described cannot be followed. In such cases we must cut cautiously from the skin through the different textures,

Fig. 201.—Proper line of incision in a scrotal hernia, to expose the neck of the protrusion and deep constriction.

till we reach the sac. If any vessel, no matter whether large or small, begins to bleed, it must be secured, not so much on account of the risk from loss of blood, as that the hæmorrhage would interfere with the after proceedings. We easily recognise the external oblique aponeurosis, which is generally distended by the hernia. We open the aponeurosis at the lower ring, and then with a probe-pointed bistoury slit up the inter-columnar fascia to the upper part of our incision in the skin. We have now before us the hernia covered by the cremasteric fascia, and we require to make an incision about an inch in length through that covering, by raising it with a pair of forceps, and opening it; then on a flat director we slit up this fascia, and the edge of the internal oblique muscle to the upper part of our incision. We are now upon the fascia propria of the hernia, which we next slit up.

In the extra-peritoneal operation, it is at this point that we require to begin to clear the neck of the sac, which, if the incisions have been properly made, is now distinctly visible. We see the bulging above and below the constricted point. This constriction of the hernia we touch lightly with the knife, until we find the constricting fibres give way, and then we may attempt to reduce the hernia. If we cannot do this easily, and if we find that the constriction is in the neck of the sac, we must open it and divide the stricture from within.

The sac must be very carefully opened. Sometimes it is not very easily recognised. We pinch up a portion with the finger and thumb, or we feel if there is anything gliding under the sac; if so, we raise it, cut a little bit of it horizontally, and then enlarge the opening. If no fluid escape, we should introduce a flat director (fig. 204), enlarge the opening, and make sure whether it is really the sac we have opened. If it be the sac, and if there be no fluid between it and the bowel, we then recognise the gut; but if we were to cut rashly we might cut into the bowel. We open the sac, and enlarge the incision upwards and



Fig. 202.

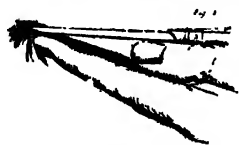


Fig. 203.

downwards, then introduce the flat director under the edge of the constriction (fig. 202). A probe-pointed bistoury, laid flat upon the director, is glided under the constriction, and its edge is then turned upwards so as to divide the sharp margin directly upwards at its centre over the neck of the hernia.

We can then get our finger so far under it as to feel the constriction

Fig. 202.—Shows incision in a scrotal hernia and division of coverings on director. The incision is placed too low, not over the neck of the protrusion as in fig. 201.

Fig. 203.—Mode of using probe-pointed bistoury to divide the deep constriction.

and guide the bistoury. The director should not be used in dividing the deeper part of the stricture, but only to allow us to divide or notch the tight margin, and then we can complete the division of the stricture more safely by using our finger as a guide. In operating on large scrotal herniæ great care should be taken not to open the sac too largely. It should be opened about an inch or little more below the neck, and slit up to the point of constriction, and then the stricture

fully divided by the probe-pointed bistoury, guided on the finger or flat director. If this be done, and the constricted portion gently disengaged and drawn down, and then returned, moderate equal pressure on the fundus and body of the sac made with the left hand, whilst the right hand regulates the neck of the protrusion, will usually suffice to reduce it, without any undue fingering or manipulation of the intestine. On the contrary, if this rule be not observed, if the incision be prolonged downwards and the sac largely slit up throughout nearly its whole extent, the convolutions of the imprisoned intestine escape in all directions, twist upon themselves, render the division of the constriction more difficult, and, worst of all, require too much handling of the intestines to repress and reduce them (fig. 205). The same observations apply to all large herniæ. In certain cases, complicated by adhesions or other peculiar conditions, we must open the sac largely to examine and deal with the complications, whatever these may be; but such cases are exceptions to a great general rule.

In cases where the state of the hernia contra-indicates the extra-peritoneal operation, we open the sac without making any attempt to divide the constriction on its exterior. The sac is opened and the constriction divided, as described above.

After the operation, the margins of the incision are united by sutures, then a flat compress of lint or sponge wrung out of weak carbolic or boric lotion, supported by a folded soft towel or napkin, and secured by the spica bandage, is applied. In applying the bandage the thigh should be slightly flexed on the pelvis, so that when the limb is stretched it becomes firmer.

The same general rules as to the extent and method of making the incisions apply to the operation for direct or ventro-inguinal hernia as for oblique. We must, however, bear in mind the difference in the anatomical relations which I have previously alluded to. First, that the protrusion occurs through some opening or weak point in the conjoined tendons, nearer the mesial line than the deep ring, consequently that the hernia only occupies the lower part of the canal, rather crossing the direction of the cord at its lower part, so that this form of hernia has fewer coverings; it is only covered by the skin, superficial abdominal fascia, and the intercolumnar or external spermatic fascia,—



Fig. 204.

sometimes termed the fascia propria of Camper,—and sub-peritoneal cellular tissue; the coverings derived from the internal spermatic and cremasteric fasciæ being absent. Secondly, that at the deep part of the wound the relation of the neck of the protrusion to the deep epigastric artery is reversed; for as this hernia protrudes nearer the mesial line of the body, the artery lies to the outer side of the neck of the sac. At the same time, if the incision of the deep constriction be carried directly upwards over the centre of the neck of the protrusion, parallel to the linea alba, as recommended in oblique hernia, the artery runs no risk (fig. 200). If, however, the edge of the knife is to be inclined to the side, it must be directed towards the internal side of the neck of the hernia in a direct hernia, and outwards in oblique; but the rule is straight upwards. The after-dressings and treatment are the same in both forms.

Hitherto I have been speaking of the two general forms of inguinal hernia, but under the head of oblique inguinal we meet with two important modifications of hernia—the congenital and infantile. Of



Fig. 205.

these the former is the more common, and I think the most important, perhaps, of almost any modification of hernia that we meet with, both as regards diagnosis and treatment. The latter is not so easily defined, and I suspect the arrangement of parts must be often varied, to judge from the varying descriptions of it given by different authors. We must now turn our attention to these forms of inguinal hernia; and first to the congenital hernia.

By the term CONGENITAL HERNIA we do not merely mean a hernia

Fig. 205.—Shows the result when in a case of Scrotal Hernia the sac is largely exposed and opened, and the intestines protrude and embarrass the operator.

which comes down at birth, but we mean a hernia arising in connection with a peculiar congenital condition of the inguinal canal, which often continues to exist throughout life. The general sac of the peritoneum and the sac of the tunica vaginalis, as you are aware, are originally one continuous serous sac. As the tunica vaginalis descends into the scrotum, the portion passing through the canal becomes narrowed, and bulges out when it emerges into the scrotum; thus two serous sacs are formed, connected by a narrow canal, which continues pervious till the birth of the child, when in general the communication becomes obliterated. It is usually said that the tunica vaginalis is drawn down into the scrotum as the testicle descends, but the tunica vaginalis is generally in the scrotum before the testicle comes down. When this continuity between the peritoneum proper and the tunica vaginalis continues



Fig. 206.

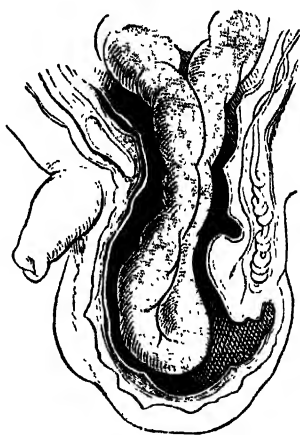


Fig. 207.

after birth, if the canal does not become obliterated, then there is a narrow communication between the abdomen and the tunica vaginalis along the cord (fig. 206). This congenital condition not only explains the peculiar relations of the intestine, but requires also to be kept in mind with reference to diagnosis, and to differences of opinion as to the nature of scrotal swellings in young children. It not unfrequently happens that a child is taken to a surgeon who, on examining the swelling and finding it translucent and containing no gut, pronounces it to be a hydrocele. The child may then be shown to another surgeon who finds a portion of gut in the scrotum amongst the fluid, and reduces both gut and fluid with the usual gurgling sound into the abdomen, states it to be a hernia, and orders a truss to be applied. The first surgeon has seen it when no intestine happened to be down, but had he tried to reduce the swelling the ease with which the fluid would have returned into the abdominal cavity should have shown him that it was not an ordinary hydrocele, but that there was a state of

Fig. 206. Congenital state of parts permitting Hernia to descend:

Fig. 207. Congenital Hernia.

parts which would be likely also to permit intestine to descend. In some cases the communication is very small, so that no gut can descend into the tunica vaginalis; but in such cases the fluid can be slowly pressed back into the peritoneal cavity, showing the true nature of the case to be what is termed congenital hydrocele. The proper treatment in such cases is the use of a truss to prevent the bowel passing down and by its pressure tending to promote closure of the passage of communication; and when that is effected, when the fluid in the tunica vaginalis can no longer be pressed back into the peritoneal cavity, then the ordinary treatment for hydrocele may be adopted.

A hernia or portion of bowel may descend through this narrow canal into or towards the cavity of the tunica vaginalis, and this is what constitutes a congenital inguinal hernia (fig. 207). The tunica vaginalis is the sac of the hernia. The testicle is very often found lying in the canal, and the cord shorter than usual. When the hernia descends into the scrotum in such a case, the tunica vaginalis forms the sac of the hernia. In many cases a portion of gut merely protrudes through the lower opening of the canal of communication, just within the tunica vaginalis in the scrotum. The resistant character of the canal through which it has passed prevents more passing down, and in such circumstances there is a difficulty in the diagnosis. In a strangulated congenital hernia, where we can see and feel fluid within the scrotum, with pain in the lower part of the abdomen, we may find nothing but what seems to be a thickened cord; yet, in some of these cases, we find that what appears to be a swollen spermatic cord is really a portion of intestine contained and tightly constricted within the canal, and often strangulated.

The reason why I draw your special attention to congenital inguinal hernia is, that it requires to be, if possible, more promptly attended to than any other form. The state of the parts and the degree of constriction are such, that bad consequences very soon follow any attempts at reduction, unless they succeed. In many instances, continued attempts at reduction do much harm. As regards the operation in congenital hernia, the extra-peritoneal operation is not suitable, as the neck of the sac, or the narrow portion of the canal, forms the constriction; and, therefore, when operating on the adult, we must open the sac in all cases, to divide the stricture.

As regards the peculiar dangers of strangulated congenital hernia.—Any one who has carefully noticed the results of such cases must have been struck with the greater fatality in them than in other forms of rupture; whilst those who have had much experience in operating can scarcely have failed to be surprised at the amount of morbid action which is often presented in the contents of such a hernia in a very short period of time, compared with what we find even in cases of femoral or umbilical herniæ. These results seem to me to depend chiefly of course on the nature of the constriction, but are increased or modified by the extent of the protrusion, and the treatment adopted prior to operation. The very nature of the constriction is essentially

dangerous ; for if we consider the long narrow canal of communication which exists between the general peritoneal sac and the tunica vaginalis, and the process of condensation, elongation, and increased obliquity, which it undergoes as the patient advances towards adult age, we will at once perceive how difficult it will be for a hernial protrusion to descend ; and having descended towards or into the scrotum, and become distended or congested, how almost impossible to return it by taxis ; especially when we further recollect the unyielding texture of the walls of the canal of communication in such a case. This resistant unyielding character is easily seen when the hernia is down, and indeed often forms a cause of doubt as to the scrotal swelling being a hernia ; for there is apparently no continuous neck passing towards the abdomen—notling but what feels like a slightly swollen and hard spermatic cord, so firmly is the gut embraced throughout the whole length of the canal ; and then the bowel, emancipated in the cavity of the tunica vaginalis, becomes distended and congested, and tightly nipped above by the sharp resisting margins of the lower opening of the canal.

These are what I consider the essential dangers of the congenital rupture. But it is evident that they will be much increased, if, as often happens, a large portion of gut has suddenly been protruded, in consequence of some violent effort or force. Then even slight efforts at reduction only make matters worse ; and in such a case I have seen the coils of small intestine highly inflamed, matted together, and at some points gangrenous, even in the course of sixteen hours ; whilst in another I have seen the peritoneal coat of the intestine abraded and cut by the stricture, and the bowel inflamed, in less than six hours from the time of descent, where the patient had been very restless, and had made violent efforts at reduction. On the other hand, if only a small portion of bowel has passed beyond the lower margin of the canal of communication, or where the bowel has been somewhat protected by a portion of omentum, I have found, even after the lapse of thirty hours, not much more alteration than in an ordinary case of hernia. In one case, that of a young man aged about twenty-one, who had suffered from hernia as a child, the hernia came down suddenly while he was at his work. I saw him sixteen hours afterwards, but on operating I found a very large quantity of gut in the tunica vaginalis, which was much inflamed and adherent. In another case a man received a blow upon the testicle, and complained of pain and sickness when I saw him. The general opinion of others who saw him was that it was acute hydrocele. I thought, however, that it was a case of hernia, and I accordingly cut down upon it ; for even if it had been an acute hydrocele the incision would have done no harm, while, if it was a hernia, it was the only safety for the patient. I found a quantity of serous fluid very like that of a hydrocele, but on further examination I found a small portion of gut tightly constricted and highly congested protruding into the upper part of the tunica vaginalis. The constriction was relieved, and the man recovered, but the diagnosis of the case was exceedingly difficult, and most of those who saw it

thought it was merely swelling of the cord, arising from a blow on the testicle.

Attempts at reduction are not very likely to succeed, owing to the direction of the canal, except in young children; in them I have frequently succeeded, but we should not try the taxis too persistently. In a young man on whom I operated without attempting the taxis at all, I found that the posterior part of the tunica vaginalis had been ruptured from the attempts at reduction which had been made before I saw the patient. In this case the tumour was confined to the canal, neither testicle having passed through the external ring; the swelling was large, tense, and painful, and the patient had attacks of vomiting. All attempts by taxis had failed. My resident surgeon ordered a distending enema, and this brought away such a copious loose stool as to make me doubt the tightness of the constriction; still, as the tumour was tender, I put the patient under chloroform, and cut down upon it, and found a large sac, partly occupying the canal, and partly pressing up between the parietes and peritoneum. On drawing it down, to bring its neck within easier reach, I found the sac had rent on its posterior aspect from the previous attempts at reduction, and on laying it freely open there was exudation of blood here and there on the surface of the bowel, showing the danger of the taxis in such cases. This patient ultimately did well.

There is no peculiar difficulty or danger in the operation. You make an incision over the swelling, and cut down upon the parts in the usual way. You must expose the inguinal canal and the upper part of the scrotum, and then you can easily divide the stricture without any danger, just as in inguinal hernia; but to relieve the constriction you must divide the whole length of the canal of communication from its lower to its upper opening.

The after-treatment is similar to that of ordinary inguinal hernia—only we must avoid pressure on the testicle, if it lies in the inguinal canal. In some cases we can draw it so far down as to be able to apply the compress higher up. But in cases where the shortness of the cord will not admit of this, there is often difficulty in avoiding pressure upon the testicle in retaining the hernia, and even without direct pressure it sometimes inflames, swells, and gives trouble in the treatment of these cases.

INFANTILE HERNIA exists in different forms, and has been differently described by surgical authorities. The general characteristics are that it passes down behind, not into, the tunica vaginalis, very often splitting up the constituent parts of the cord from each other, so that it has the spermatic vessels sometimes on the surface and sometimes at

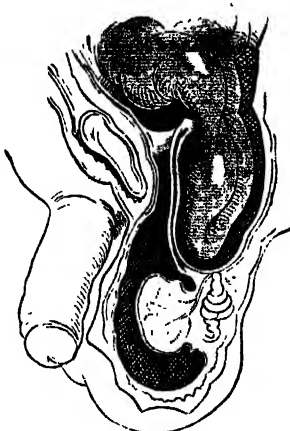


Fig. 208.

Fig. 208. Diagram illustrative of Infantile Hernia.*

one or other side. The principal peculiarity is, that in operating on such a hernia we first come down upon a serous sac, which, when opened, contains no gut. Behind this is some cellular tissue, and under this again is the sac containing the intestine. When operating, therefore, if we remember that part of the tunica vaginalis corresponding to the cord lies in front of the true hernial sac, we will be prepared to proceed without hesitation if we meet with this complication.

LECTURE CV.

FEMORAL HERNIA—Anatomy of the region in both Sexes—Comparative frequency of Femoral Hernia in Males and Females—Difficulties in Diagnosis, and how to meet them—Reasons for operating early—Mode of operating—Ventral Hernia: its Nature and Treatment—Radical Cure of Hernia—Consideration of the various methods for effecting it—Statistics of Operations for Strangulated Hernia.

FEMORAL HERNIA can protrude only at one part of the abdomen. On looking at the interior of the pelvis and abdomen when the peritoneum has been stripped off, we notice that the fascia iliaca, as it passes down, is perfectly continuous on the outer side of the iliac vessels with the layer of fascia passing up to line the posterior abdominal parietes. In fact, there is no break in the continuity of these two fasciæ from the superior anterior spine of the ilium to the outer side of the femoral sheath, so that in this space no hernia can protrude. When the fasciæ arrive at the vessels, they arrange themselves into a funnel-shaped sheath to admit of the passage of the great vessels into the thigh. That layer of these fasciæ corresponding to the posterior aspect of the transversalis muscle passes down in front of the vessels, and can be traced continuously with the deep portion of the fascia lata, while the fascia iliaca, which passes behind the vessels, sweeps down posteriorly, or on a deeper plane, and corresponds to the pubic or internal portion of the fascia lata of the thigh. Where the vessels pass out, whilst there is a separation of these layers of fasciæ, they send down a septum between the vein and the artery. Besides this fascial funnel the vessels have also their distinct and proper cellular sheath, and this prevents any protrusion descending between the vein and the artery. But between the iliac vein and the pubes we have a space almost unoccupied. This space is bounded on the inner side by crescentic fibres from the crural arch and from its falciform process, and also fibres from the lower pillar of the external oblique tendon and conjoined tendons, passing down towards the pubes, and towards the spine of the pubes, forming Gimbernat's ligament, or the crescentic margin of the crural arch. Behind we have the pubes, covered by the pectineus and fascia; and in front we have the crural arch formed by Poupart's ligament and the abdominal fasciæ.

The space so bounded is one of the weak points of the abdominal walls; it is merely closed internally by a delicate layer of tissue derived from the transversalis fascia, called the internal cribriform fascia. There is often a sort of indentation corresponding to the space, which is filled by a small, deep, absorbent gland. This is the only point where a femoral hernia can protrude. The protrusion passes down on

the inner side of the sheath of the vein, and passes through the crural ring or canal, which is bounded in front by the crural arch, internally by Gimbernat's ligament or crescentic margin of the arch, behind by the fascia iliaca, and on the outer side by the sheath of the femoral vein (fig. 209). Through this ring or space the hernia passes down



Fig. 209.

and appears in the thigh, immediately below and behind the falciform edge of the fascia lata, which is stretched in front of it, and it lies upon the pubic portion of the fascia lata. The hernia is covered in this region by the cribriform fascia, the thin upper portion of which it either distends and carries before it, or it sometimes dilates and passes through one of the foramina in that structure. The relations of this cribriform fascia should be carefully studied, and nothing in regard to the anatomy of femoral hernia has puzzled me more than to understand what can be the

reason for such diversity of description and views as to the cribriform fascia; for, after many years' experience in dissecting and demonstrating these parts, together with careful examination of them for my own special satisfaction, I have not been able to see any reason for describing this cribriform fascia otherwise than as a continuous portion of the fascia lata, always presuming, of course, that no artificial dissection is made to separate the natural connections of the parts. If the subcutaneous superficial fascia be carefully raised, commencing over the saphena vein, and the fat be cleaned away with the handle of the scalpel, so as to expose the saphenic edge, the falciform process, and the fascia lata generally, we see between the falciform edge above, and the saphenic edge inferiorly, a continuous layer of fascia stretching from the iliac towards the pubic portion of the fascia lata; thinner, perhaps, and reticulated by foramina for vessels, but still perfectly continuous with the two great portions of the fascia. If the handle of the knife or a probe be passed under the saphenic edge, and pressed downwards, it is resisted in its progress, showing that here also, though the edge is abruptly reflected, the membrane is continuous, and above, at the falciform process, where the reflexion is less sharp, the continuity can be seen. It is only by artificial dissection that we can destroy this continuity, and make a distinct saphenic opening as it is called. As to the description of its being a portion of the superficial fascia of the thigh, that is evidently incorrect; for the saphena vein, the superficial branches of the common femoral artery, and their accompanying veins, together with the superficial set of femoral glands, form a natural separation between that fascia and the cribriform. As little

Fig. 209. Diagram illustrative of Femoral Hernia—(a), the protrusion; (b), vein; (c), artery; (d), external abdominal ring.

do I see any reason for considering or describing the cribriform as a distinct structure, for any such distinction must be purely artificial.

As the space already described between the iliac vein and Gimbernat's ligament is wider in the female than in the male, femoral hernia is commoner in females than in males, though in the latter it is not uncommon. When a hernial protrusion passes through the femoral opening, then, from the way in which the cribriform portion of the fascia of the thigh is arranged, the protrusion tends to pass up towards the abdomen, so that it lies obliquely, and resembles in some instances a small inguinal rupture, and this flexure of the body of the hernia upon its neck constricts it still further. If we attempt the taxis, therefore, whilst the gut is in this position, we will simply bend it further upon itself, and cannot possibly reduce it. We must first bring the body of the swelling in a line with its neck, and the whole into the axis of the opening through which it has passed out. The hernia descends into the thigh through the saphenous opening at its upper part, but the term has given rise to much misapprehension, for it is sometimes understood to mean the saphenous edge or lower part of the saphenic opening; that edge is reflected back upon the vein, and therefore a hernia could never pass out there unless it passed down between the vein and its sheath, and this it is said does happen sometimes, but I have never seen a case of it. At the upper part of the saphenic opening we have the weak point corresponding to the femoral ring, and when a hernia descends, it passes down immediately below the falciform edge, and invariably occupies the inner compartment of the fascial sheath.

A hernia which has emerged at the point just indicated, when of small size, passes at first directly down on the thigh, projecting the superficial cribriform fascia, glands, and skin, before it, and forms a small rounded or sometimes a flattened swelling at the upper and inner part of the thigh immediately below the crural arch. As the hernia enlarges, the connections of the cribriform fascia prevent it passing farther down the thigh, and so the body of the swelling is pressed up towards the abdomen, and lies along the line of Poupart's ligament—its deep surface resting on the fascia of Scarpa, whilst its superficial aspect is in relation with the common superficial fascia of the groin, and the ascent of the swelling is limited above by the angle of union of the fascia of Scarpa with the superficial fascia of the abdomen. The superficial inguino-pudic and epigastric arteries and veins are stretched over the hernia as it ascends. This hernia, therefore, whilst it will present all the usual symptoms absolutely diagnostic of hernia in general, requires great care on the part of the surgeon to distinguish between it and other swellings occupying the same or nearly the same position. The difficulty in diagnosis will be increased if the swelling be of small size, or if the protrusion be largely composed of omentum, for in these circumstances the important diagnostic of direct impulse on coughing is often very imperfect, even when the hernia is not constricted. In a tightly-constricted hernia there is no direct impulse, as I have already pointed out.

The diseases in the inguino-femoral region, which may be mistaken for femoral hernia, are enlarged and partially suppurating glands, chronic

abscess of the iliac fossa pointing or projecting at the femoral ring and taking the same position as the hernial protrusion, varicose dilatation of the femoral vein, cystic and fatty tumours, and psoas abscess. Besides these distinct diseases the surgeon requires to diagnose this hernia when it is reflected on the abdomen, from a small oblique inguinal hernia.

As one or more of the inguinal glands lie directly over that portion of the cribriform fascia which a femoral hernia pushes before it, you will easily understand how closely such an inflamed and swollen gland may simulate this hernia; indeed, as I have seen, you may have both conditions present, and on cutting through the suppurating gland you may expose a small hernial sac, but in such cases the general symptoms will so far guide your practice. If the bowels act freely under the use of castor-oil or other gentle purgative, and there be no vomiting, and merely the tender swelling, and the skin not easily movable over the tumour, the diagnosis is that it is an inflamed gland. If, moreover, you detect any cause of local irritation likely to lead to such glandular swelling, and if the tumour, at first comparatively small and hard, gradually becomes larger and soft, or fluctuating, with red adherent skin, and general feverish symptoms, this diagnosis is strengthened. But if the swelling is at first deep-seated, with impulse on coughing, and can be reduced, it is hernial. If, with all clear indications of an inflamed or suppurating gland, the symptoms of acute incarceration or strangulation supervene, these should decide the prompt interference of the surgeon, by cutting down on the swelling; and should his incision expose an inflamed gland or give vent to purulent matter, he must not be thrown off his guard, but proceed, and make quite sure lest there be a small hernia present. I recollect, when a student, reading a criticism in a medical journal on a hospital surgeon for operating on a case of supposed femoral hernia. The article was headed, "Opening an abscess by a T incision!" Though I have since then seen a good deal of surgical practice, I know of no deadly results which would be likely to follow opening an abscess by a T incision, but I do know that in a doubtful case leaving a hernia strangulated would be fatal.

Chronic abscess formed in the loose subperitoneal cellular tissue on the surface of the fascia iliaca makes its way towards the weakest point in the same way as the hernia, and therefore bulges at the femoral ring. There is impulse on coughing, the swelling can be reduced, and even for a time retained by the finger after reduction; and except, perhaps, that it wants the firm elastic feeling of hernia, the symptoms are very similar, and the surgeon may be misled by the patient stating that the lump appeared suddenly after violent coughing or some other exertion. But, if there be a circumscribed fulness of the parts above Poupart's ligament, when the swelling is repressed, if the patient be pale and unhealthy-looking, or if there be pain in the back, suspicion should be aroused; and if the patient has been trying a truss, and finds that the swelling always manages to escape from under the pressure, the nature of the case becomes more apparent, and gradually the increase and character of the swelling leave no doubt of its true nature. But at first the difficulty of diagnosis is considerable.

In psoas abscess, which arises under the fascia iliaca, there is not in general any real difficulty in diagnosis; the matter points lower down, bulging the fascia lata before it, and its position lower down in the thigh, in conjunction with the history of the case, leaves little doubt as to its character.

Varix of the femoral vein, distending and pressing out the thin fascia on the inner side of its sheath, has somewhat the appearance of a small hernia; but the sensation to the finger is quite different, and, moreover, it must be very rare indeed that varix of the femoral can exist without a varicose condition of the saphena and other veins of the lower extremity, and this will generally give a clue to the nature of the swelling.

Except when symptoms of strangulation exist, cystic and fatty tumours in the femoral region will be distinguished from hernia by their form, feeling, want of direct impulse, and irreducibility. They may, however, prove puzzling to the surgeon when operating for symptoms of strangulation. I have in several cases met with such cysts overlying a hernia. In one case I found no less than four cysts, about the size of large grapes, under the fascia, overlying a small strangulated hernia, and when I opened the first I thought, from the escape of serous fluid, that it was an empty hernial sac, but on perceiving the others I saw their real character, and dissected them off and exposed the true sac.

As regards the diagnosis between femoral and small oblique inguinal herniæ, I have never found any great difficulty in distinguishing them. Though a femoral hernia does ascend obliquely towards the abdomen, it does not pass up to the level of, nor in the direction of, the deep abdominal ring. The connection between Scarpa's fascia and the common superficial fascia a little above Poupart's ligament prevents it ascending far, and so it passes more transversely out towards the iliac spine, and does not present the obliquity of an inguinal hernia. Besides, unless the sac and its fascial coverings have become adherent to the adjacent textures, we can, even in strangulated femoral hernia, bring down the tumour from off Poupart's ligament, so as to ascertain distinctly its relations and the point from which the neck emerges. It is only in old adherent and irreducible herniæ that difficulty in diagnosis between the two forms can occur.

The crural arch is of great importance in reference to the taxis and operation, and considered anatomically it is a very complicated structure; but we have not time to enter fully on the subject here. I would merely refer you to the simple and comprehensive statement given by Mr. Liston of the disposition of the lower crural arch, as distinguished from Poupart's ligament—which I have verified in its main points in a very large number of dissections—as a model of anatomical description. He explains that the iliac portion of the fascia lata, together with its falciform process, is formed by the union of the deep layer of the abdominal superficial fascia (Scarpa's fascia) with the fascia transversalis, below Poupart's ligament; which ligament lies enclosed between these two laminae, above their angle of junction, so that the combined fasciæ referred to form in fact the resisting portion

of the arch which is in contact with the neck of the hernial sac. This can be proved by dividing and removing Poupart's ligament, and rendering tense the fasciæ, when the constricting edge will still be felt. The only point of description in which Mr. Liston's views are defective in regard to these structures is, that he did not keep sufficiently in view the strong attachment of the deep layer of the structure to the posterior reflected edge of Poupart's ligament, and the tension consequently exerted upon that ligament by the fascia lata in certain positions of the limb. In applying the taxis in femoral hernia, we are told to flex the leg on the thigh, and the thigh on the pelvis, and rotate inwards. How does this affect the crural arch? It cannot affect Poupart's ligament directly, because this stretches between two fixed osseous points, and it is only in so far as it has curved downwards by its attachment to the fascia lata that we can act upon it at all. It is only by acting on the falciform edge that we can relax the lower crural arch. As the fascia iliaca and fascia transversalis pass down, Scarpa's fascia, which is the deep layer of the superficial abdominal fascia, becomes perfectly continuous with the anterior layer of the iliac or outer portion of the fascia lata; whilst behind Poupart's ligament the fascia transversalis descends and becomes continuous with the posterior or deep surface of the fascia lata, and these two laminae close below Poupart's ligament, and form the falciform process, and the lower crural arch the constricting edge. In the taxis, therefore, we relax this edge, but Poupart's ligament only indirectly.

In applying the taxis, after using the general means formerly mentioned, we bring the tumour, if it be a large one, from off the surface of the abdomen, and press it directly upwards, after bringing it into a line with the axis of the opening through which it has passed. In most cases, at an early period, we can thus reduce the hernia easily, but sometimes the textures offer great resistance to reduction, and the bowel becomes so altered in its relations and proportion to the opening, that we can no longer return it. If left long unreduced, the sharp margins of the constriction would cause great mischief, and therefore in femoral hernia operation should be resorted to early.

Operation.—In operating for femoral hernia, we should see distinctly the falciform edge and parts

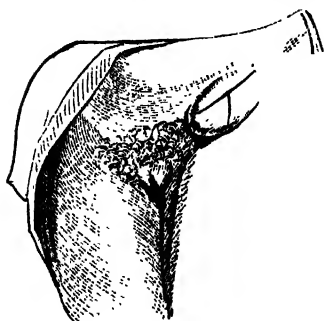


Fig. 210.

immediately over the neck of the sac. We therefore make an incision, with this object, over the whole length of the tumour, if small from above downwards, and I generally make another slightly oblique along the line of Poupart's ligament. In very fat patients I make a crucial incision. I then divide the skin and superficial fascia, push aside any glands, and secure any vessels which may bleed.

When the superficial fascia is fully divided, the body of the hernia

Fig. 210. Lines of incision in Femoral Hernia.

is released, and appears like a rounded protrusion lying loose, and generally tilted up over Poupart's ligament, as shown in fig. 211. The smooth texture covering the hernia is generally the cribri-

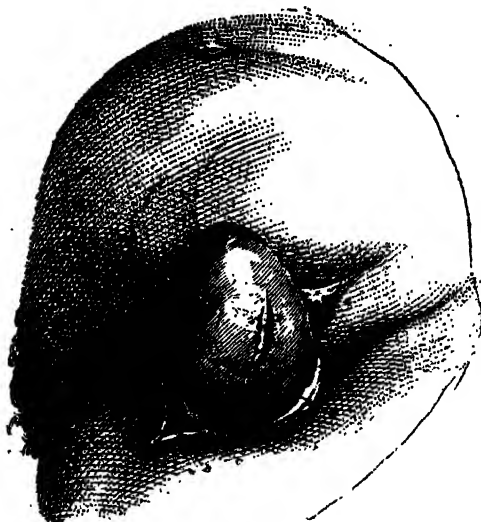


Fig. 211.

form fascia, but we may have to cut cautiously through two or three layers of condensed cellular tissue before we come to the sac. We should try the extra-peritoneal operation if the hernia has not been very long down, for we see the neck of the sac very distinctly, and by touching the constriction lightly with a bistoury we cut through the resisting fibres. If we find that the indentation is effaced, and that the sac becomes more distended, then the constriction is divided, and we next empty the sac of its contents and reduce them. But if we cannot do this, we must open the sac and divide the constriction from within. In small femoral herniæ we must do this very cautiously, for there is often no fluid in the sac, and recent adhesions may even have taken place between it and the bowel. We should introduce the finger, and feel whether there be adhesions. In dividing the stricture in femoral hernia, the surgeon passes his finger or the flat director in front of the bowel, and somewhat to its inner side, and with a bistoury introduced flat on the finger he insinuates its point through and beyond the constricting edge, then turning the edge of the knife upwards and inwards, he divides the falciform edge at its junction with the deep crescentic margin, or Gimbernat's ligament. When the deep crescentic margin is divided we at once relieve the falciform edge and the constriction, and the bowel can then be reduced. The case is treated

Fig. 211 represents the manner in which femoral hernia will sometimes rise from the depth of the groin when freed of the integuments and the binding of the fascia.—A, B, The extent of the incision of the integuments. CC, An aponeurosis dissected off the proper sac. D, The hernia covered by the proper sac. The tumour is of a pyramidal form. E, A cut through the sac.

afterwards like any ordinary case of hernia. We should not carry the knife directly upwards, but obliquely upwards and inwards, so as to divide the crescentic margin where it forms the upper and inner part of the ring. By doing so we avoid all risk of injury to the vein or to the epigastric artery, or the spermatic cord in the male.

As regards the dangers of the operation, there are hardly any incidental to the operation itself if it be properly and carefully performed; we simply divide the skin and fasciæ, and sometimes also the sac. The only vessels which require to be divided are the branches of the inguino-pudic artery. They are generally cut in the first incision, and should be secured at once as divided. The obturator artery sometimes

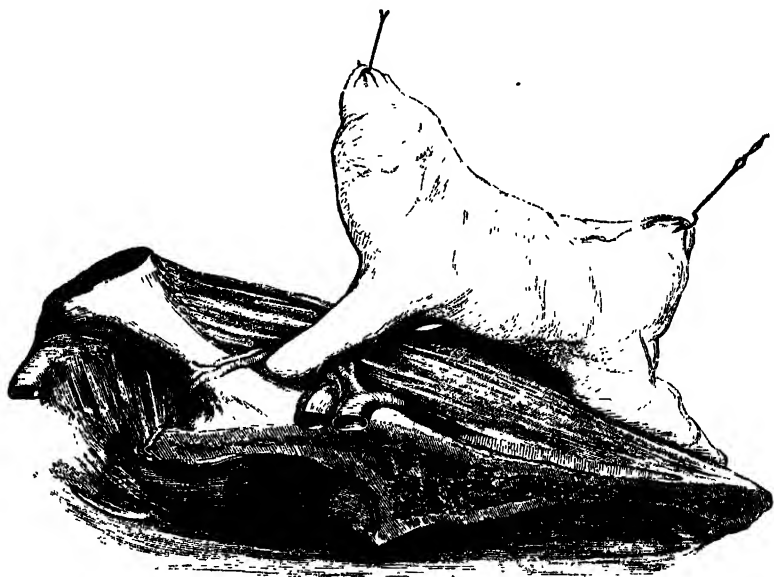


Fig. 212.

courses close round the inner side of the neck of the sac in femoral hernia, and under such circumstances it has been wounded in dividing the constriction (fig. 212). This occurs when the obturator arises, in common with the deep epigastric, by a long common trunk, which, after ascending on the parietes, sends off the obturator, which in passing to its destination lies so as to be in the above-mentioned relation. In the cases where the obturator comes off from the external iliac artery it lies beneath a hernia passing through the femoral canal, and consequently can be in no danger. In one remarkable case, on which I operated, the irregular obturator artery so constricted the large intestine forming the protrusion that I was obliged to tie it with two ligatures

Fig. 212. This woodcut was taken from a case operated on by the late Dr. Richard Mackenzie. The obturator, which encircled the neck of the sac, escaped division. I am indebted to Professor Struthers, of Aberdeen, for the use of the woodcut. A notice of the case, by Dr. Struthers, will be found in the *Edinburgh Medical Journal*, July 1855, page 74.

and divide it between them before I could reduce the hernia. The case will be found detailed amongst the Clinical Cases ; but it is unique, I believe, and I think it rather proves that in ordinary femoral hernia wound of the irregular artery may be avoided if care be taken to examine with the finger before dividing the deep constriction.

UMBILICAL HERNIÆ, as the name implies, protrudes at the navel. VENTRAL HERNIÆ may protrude either in the mesial line or at one or other side. In all these cases the gut comes through a distinct circular opening of a dense aponeurotic character, the thinned edges of which are prolonged over the hernial sac, forming a sort of fascia propria. In many cases the hernia is very large. Sometimes it contains the larger portion of the floating viscera of the abdomen, the abdomen itself being contracted, and not having capacity to contain the viscera, which have made for themselves a sort of new cavity under the skin and fasciæ.

In reducing an umbilical or ventral hernia by the taxis, the patient should be placed with the shoulders raised, and the lower limbs flexed towards the belly, so as to relax the abdominal parietes. We first try to disengage and draw down the neck, and then gathering the body of the swelling, and raising it slightly, we press it directly backwards in the line through which it protruded. In large umbilical herniæ, even when reducible, the reduction is not very readily accomplished, owing to the difficulty of managing such a bulky mass. Another cause of difficulty is that most umbilical or ventral herniæ contain a large amount of omentum ; and this, when long out of the abdominal cavity, becomes loaded with fat, and so altered in form as not easily to pass back through the opening, the margins of which are very resistant.

In operating for these herniæ, if we were to make an incision corresponding to the bulk of the tumour, or a crucial incision, the consequence would be that the bowels would come out by it, and, instead of facilitating matters by a free incision, we should only make them much worse. No matter what the size of the hernia is, the incision ought to be small. We require to make an incision $2\frac{1}{2}$ or 3 inches long, beginning about an inch above or below where the hernia protrudes, and continue it down over the tumour. We first divide the skin and superficial fascia, and then we come down upon the thin fascia immediately investing the hernial sac. In one case I found the fat under the skin in contact with the omentum, the sac being apparently worn through at one point by the pressure. In general, however, the sac is well defined, and after dividing the skin and superficial fascia we can draw down the tumour, and the constriction becomes apparent. In performing the extra-peritoneal operation in ventral herniæ, we divide the textures very carefully till the constriction ceases to exist, cutting directly upwards. In most cases, however, it is better to open the sac by a small opening, and introducing the finger, feel till we come to the point of constriction, then introduce a director, and divide the constriction upwards for about a quarter of an inch. We must be careful that the bistoury has the probe on the end, and not on the back, for the stomach and colon are sometimes displaced and distended in umbilical herniæ, so that they might be injured by the point of the knife. Another thing to be

attended to is, that when we require to divide the constriction freely in a very large hernia, instead of dividing further up in the medial line, we may either draw up the hernia and repeat the incision below, or we may divide the constriction at the sides to a certain extent. It is a complete circular constriction, and we may relieve it in this way by division of different parts of the circle. The hernia is then left with the skin and sac upon it, and we can gradually reduce it bit by bit.

Sometimes, in old umbilical herniæ, the convolutions of the bowel are contained in hollows in the cellular tissue, so that we require some little time to reduce the hernia. In other cases the bowel is adherent; but if the constriction be divided that is the main point. As regards a large incision, I can only say that I have seen it once, and I would never wish to see it again, for the whole convolutions of the bowel were spread over the abdomen, and it was very difficult to get at the constriction. A moderate incision is quite sufficient, owing to the comparatively superficial position of the protrusion, which is just under the skin and superficial fascia. In some cases where, in operating, we find a large mass of omentum, altered in form or adherent, it may be necessary to enlarge our incision to enable us to see the state of the omentum, and judge whether we should return it by manipulation, or remove it after ligature of the vessels at its root. In such circumstances, however, we ought first to reduce all the intestine before proceeding to enlarge the incision, in order that the convolutions may not protrude and embarrass us, or run the risk of injury.

As regards large portions of omentum, either in this or other forms of hernia, if much manipulation is likely to be required to return it bad consequences are apt to follow, so that I believe it is better, in many instances, to remove the mass entirely, or in part, rather than continue efforts to return it, as it is very apt to take on a sloughy action. When the hernia is reduced, and the wound closed, we require to apply a compress of sponge enclosed in lint and a folded towel, supported by a broad binder or flannel bandage.

When lecturing on the subject of reducible hernia, and the palliative treatment by trusses, I stated that the consideration of the *Radical Cure* would be better appreciated after discussing the special herniæ. The radical cure of hernia, though it has of recent years attracted attention, and been brought prominently before the profession, has from time immemorial been attempted to be obtained by various methods—by operation or otherwise. Thus, the application of medicated compresses or plasters, combined with rest in the horizontal position for weeks or months, at one period had its successes and its advocates; and as for operative procedures having the same object in view, their name is legion, and they have been practised from the days of Abulcasis to the present time. I can merely name some of the general plans, such as exposing the sac, and, after reducing its contents, applying the heated cautery to the exterior of the neck of the sac; or even opening the sac and cauterising the interior by actual or potential cautery—ligature of the neck of the sac, so as to cause consolidation and obliteration—incision of the sac—excision of the sac, either by dissecting it

from the scrotum, or partial excision of a part of it. The last-mentioned plans were the operations which, together with lithotomy, at one period formed a specialism, as we would now call it, in the hands of itinerant operators like Franco and Frere Jacques;—some of them, however, so ignorant both of the anatomy and functions of the parts, that we are told they very generally simplified their proceedings by making a clean sweep of the testicle as well as the sac.

In 1830 M. Belmas re-excited attention to this subject in France. His method seems to have been not unlike Gerdy's and Würtzer's methods. It consisted in inserting and fixing a small bag of gold-beater's skin in the upper part of a hernial sac, leaving it there to excite inflammation and consolidation of the neck of the sac. His first operation succeeded, without inducing any bad symptoms. In another case, however, operated on at his request by Baron Dupuytren, though the patient ultimately recovered, he very nearly succumbed from peritonitis; and in other cases, subsequently operated on by M. Belmas, the risks seem to have been so great as to deter others from adopting the plan; and whilst the radical cure was still considered theoretically as a result which might be obtained at certain risk, surgeons were content, as a general rule, to trust to the palliative method by retentive apparatus.

Of late, however, attention has again been drawn to the subject, and various plans adopted with more or less success, and, so far as published results show, with less risk to life. The part of the question which I feel most doubt regarding, is the permanency of the cure. From what I have seen of some cases in which I had operated for strangulated hernia, and where great consolidation and apparently obliteration of the sac had occurred, I have for a time hoped for a radical cure; but in all of them the consolidated mass gradually became less, and was carried down before a fresh protrusion; and the same has been my experience in cases operated on by Würtzer's plan, and the various modifications of it. In regard to the general question, my own opinion is, that whilst in certain cases where the herniæ cannot be easily retained by trusses, or where circumstances render the patient anxious to try the radical cure, the operation to obtain that may be performed; yet I believe that in the great majority of instances, owing to the risks and uncertainty of absolute permanent retention without the use of a truss, the palliative treatment by trusses is preferable. In young children, as I have already pointed out, the truss, properly and persistently applied till the development of the abdominal parietes, increases the obliquity of the canal, causes a really permanent cure in most instances; and in children I therefore consider operative procedure unwarrantable.

The principles of the operations of Gerdy and Würtzer for the radical cure of hernia are nearly the same. They both consist in invaginating the sac and superimposed integuments after returning the contents of the sac, without any preliminary incision, and then carrying a needle through the upper part of the sac and the skin. By means of the strong thread with which the needle is armed, a plug of wood, gum elastic, or a portion of wax candle proportioned to the parts, is

drawn up through the whole extent of the invaginated textures, and fixed by tying the thread, and applying a compress over all. The plug is generally anointed with some irritating substance to cause excoriation of the invaginated skin, so as to make its opposed surfaces adhere when the plug is withdrawn, and, finally, firm compression kept up for some time. In Würtzer's method these objects are effected by a special apparatus, but for my own part I prefer the finger to guide the needle, so as to be sure that no portion of gut has fallen down after having been reduced. In operations performed on these plans it has been found, as I have stated, that though successful for a time the protrusion often recurs.

The method of Professor Wood, of King's College, London, seems to me to promise more permanent chances of success, though not devoid of risk. The principles of Professor Wood's operation are, limited incision of the superjacent tissues to insure proper invagination of the textures, and enable the needle to be carried with certainty and safety in the directions described. But his special object is not merely invagination of the sac and skin, but to carry the needle and copper wire suture in such directions as will enable him to draw together the aponeurotic or fascial margins of the openings through which the hernia has descended, close these openings, and narrow the canal. It is impossible, however, to describe satisfactorily the details to be attended to in performing these special operations without quoting very largely from Mr. Wood's work, and as abridged descriptions of such procedures are apt to mislead, I would refer you to Mr. Wood's monograph on the subject for details.

I referred at page 995 to the results of 127 cases of strangulated hernia on which I had operated. These results were collected about twenty-one years ago, and since then I have operated on a much larger number of hernial cases; but as I have not been so careful or methodical in noting results as I formerly was, I subjoin the brief summary of these cases referred to, as a contribution to the general statistics of strangulated hernia.

SUMMARY OF 127 CASES OF STRANGULATED HERNIA.

Nature of Hernia.	No.	Recovered.	Died.
Inguinal ¹ . .	46	38	8
Femoral . .	77	60	17
Umbilical and Ventral	4	3	1
TOTAL . .	127	101	26

Of 46 Inguinal Herniæ, 4 occurred in females. *

„ 77 Femoral „ 14 occurred in males.

The Umbilical and Ventral Herniæ all occurred in females.

¹ Of the inguinal herniæ, 8 were congenital herniæ, and of these 4 died.

The causes of death in the 26 fatal cases were as follows :—

In 17 cases the bowel was distinctly gangrenous.

„ 7 „ peritonitis had commenced prior to the operation.
(Four of these were cases of congenital hernia.)

„ 1 „ pyæmia proved fatal on the eighth day.

„ 1 „ melæna was the cause of death.¹

26

The age of patients on whom the operation has been performed is not unfrequently made the subject of notice in medical journals. I have repeatedly operated both on males and females above 80. The youngest patient I have operated on for strangulated hernia was between eight and nine months old. My oldest patient was a woman who had completed her 98th year two days previous to the operation. She made an excellent recovery, and I believe lived to complete her 100th year. The infant above alluded to also did well. Except as a matter of curious interest, however, I cannot see what the age of the patient has to do with the propriety of performing an operation of necessity such as that for strangulated hernia.

In connection with the subject of Hernia, I would briefly allude to the question of surgical interference in cases of obstruction of the bowels from *internal strangulation* of the intestine, or from *intus-susception*. From what I have said in favour of operative interference in cases in which a hernia has been reduced *en masse*, the symptoms of strangulation remaining unrelieved, you might naturally conclude that operation was equally imperative in the cases of internal obstruction. The conditions, however, are really very different. In cases of *intus-susception* or internal strangulation, we have not the same certainty either in regard to diagnosis as to the cause of obstruction, or as to the position of the constriction if it exist, or even as to our power to relieve it when found. I have repeatedly seen, in *post-mortem* examinations, the small intestine so twisted that when fully exposed the adhesions and constriction could not be relieved ; and in cases of *intus-susception*, at the period at which we would be warranted in operating, the adhesion and sloughing of the invaginated portion of bowel would generally render the operation useless. Again, in many cases of obstruction in which I have been consulted and advised delay, I have seen the patients recover under the use of calomel and opium ; so that I cannot look upon the operation of gastrotomy as affording much chance to the patient, although it is right in some cases to give what chance there is. In the cases in which I have operated and others in which I have seen it performed, the results have not been very brilliant or encouraging. Nor can the circumstances of the class of cases for which it has been proposed be considered as analogous to those of strangulated hernia. (See Clinical Case.)

¹ In this last case the protrusion, a large scrotal hernia, was returned with great ease by the extra-peritoneal operation, within sixteen hours from the time of its descent ; but the patient, before applying for medical aid, had resorted to most violent efforts to reduce it.

CLINICAL CASES

ILLUSTRATIVE OF THE TREATMENT OF HERNIA.



CASE I.—SCROTAL HERNIA. PECULIARITY IN THE CONSTRICTION.

P. B., aged 40, the subject of the present case, had been affected with hernia for a great many years. At an early period of the complaint he had worn a truss, but for some time back had discontinued its use. Since then the swelling had rapidly increased in bulk, but he had always been able to reduce it himself when it became troublesome.

On the 25th of August 1840 he was attacked with vomiting and twisting pains in the belly, which, as he had been living rather freely for a few days previously, he attributed to an "attack of bile," and did not apply for medical assistance until the morning of the 27th, when the hernial swelling became painful, and on trying to reduce it as usual he found he could not do so. He then sent for Mr. Lawrie, who tried to reduce it by taxis, but without success. I saw him for the first time, at 9 p.m. of the 27th August, along with Mr. Lawrie, when his state, as recorded in my notes, was as follows:—

"There is a large scrotal hernia on the right side, which is tense, and painful to the touch; but the contents of which can be returned into the abdomen, with the exception of a hard rounded mass, which feels exactly like an enlarged testicle, and which cannot be reduced. The cord can be felt behind the hernia, and the testicle, of natural size, in its usual position at the lower part of the scrotum. He has frequent vomiting and hiccup; the belly is tense, tympanitic, and tender to the touch, and he complains of severe twisting pains from the hernia towards the navel. Except a scanty stool when the vomiting first began, he has had no motion in his bowels since the commencement of the attack, although enemata and laxative medicines have been given. The expression of his countenance is anxious; skin rather warm, and covered with perspiration; pulse 108. He says that he never felt the 'hard lump' in the rupture on any previous occasion."

At half-past 11 a.m. I saw him, along with Drs. J. A. Robertson, J. Reid, and Duncan. The symptoms had become more urgent, and there was constant hiccup. Cold having been applied to the tumour, and the taxis again fairly tried, but unsuccessfully, I proceeded to operate. An incision about three inches long was made over the swelling, commencing at the situation of the deep ring, and continued downwards; the different coverings were then divided, and the sac exposed and opened in the usual manner, to a sufficient extent to enable me to pass my finger upwards to the ring. Having divided some sharp resisting fibres at that point, I next proceeded to reduce the con-

tents of the sac; but after reducing some convolutions of the gut, I found that the intestine seemed to be firmly fixed below; and on opening the hernial sac a little farther down, I exposed a rounded fleshy-looking mass, evidently adherent to the scrotum by its outer surface. Its appearance was singular, resembling somewhat a portion of the large intestine twisted round the lower part of the loop of the small intestine, which had been partially reduced, and some of those present thought it was an intussusception of the bowel contained in the hernial sac. As, however, it was evident that its circumference strangled the other portion of bowel, it was resolved to notch its edges slightly with the bistoury, at different parts, so as to try and relieve the bowel embraced by it. So tight was the constriction that I could not introduce the probe-pointed bistoury between its edge and the intestine, and was obliged at first to divide from without inwards. When the stricture was thus relieved, the true nature of the case was at once seen—viz. that the fleshy-looking substance surrounding and strangulating the intestine was a small subdivision of the lower part of the sac, greatly thickened, altered in structure and appearance, separated from the upper portion of the sac by a firm narrow neck, and closely adherent to the scrotum below. The bowels were then reduced, a compress and bandage applied over the wound, and a large opiate draught directed to be given immediately.

I saw him again at 3 P.M., and found that he had had no return of the vomiting or hiccough; the bowels had not yet acted, but the enema had just been given before I called. His pulse had fallen to 96, and he expressed himself as much relieved.

At 8 P.M. his pulse had fallen to 86, and was soft; he had had one evacuation after the enema; he said he felt much better, complained of no pain on pressing the abdomen, except in the immediate neighbourhood of the wound. I directed him to take half-an-ounce of castor oil, to obtain a free motion from the bowels, and to have another opiate at night. I offered to send a person to watch him, but his friends stated that they had procured one of his own relations, a sick-nurse, for that purpose, whom he would prefer to a stranger. I left strict orders to keep him perfectly quiet, and to let me know at once should any unfavourable symptoms appear.

I heard nothing further till next morning, when, on my way to visit him, I met a person coming for me, who said he had not been quite so well during the night; and on entering his room, to my surprise I found him moribund, and no one in the room with him. From his landlady I then learnt that no sick-nurse had ever been in attendance, and that his brother and some acquaintances had sat up with him; that they had given him, at his own request, a quantity of porridge and beer, shortly after which the vomiting had recommenced, with pain in the belly; and these symptoms had been allowed to go on without ever sending for me or Mr. Lawrie.

Every effort was made to procure a *post-mortem* examination of the body, but without success.

Commentary.—The points principally worthy of remark in the case are—*1st.* The unusual position of the seat of the stricture, viz. in the body of the sac, and towards the lower part of the scrotum, and the peculiar appearance of the lower part of the sac, as seen during the operation; *2d.* Some symptoms and features of the case, which, taken in conjunction with the patient's previous history, may serve as guides in the diagnosis of similar cases, and may also lead us to modify our operative procedure in such cases.

With regard to the position of the constriction, it may be said that, though rare, it has been noticed by several writers on hernia. Scarpa gives a plate of a hernia, with constriction of the sac in the scrotum, and points out the double swelling as marking the nature of the case. Lawrence mentions the case of a young man on whom he operated, in whom there was a very tight stricture midway between the testis and external ring, and where he had great difficulty in distinguishing the true nature of the lower swelling, the upper part of the sac having been opened first. Pott, Wrisberg, and Pelletan, all mention having met with similar cases; but these differ from that which I have just detailed, inasmuch as they were all cases of congenital hernia, and the constriction in the middle of the sac was caused by the contraction marking the natural division of the tunica vaginalis from the general peritoneal sac. I consider this an important difference in a practical point of view, because in these cases, although the sac would be constricted in an unusual position, and therefore render the nature of the case sufficiently puzzling, still the lower part would be of the same appearance as the upper portion, they would both present the usual appearance of serous membrane, and thus the continuity of the upper and lower portions would be more readily recognised. Whereas, in the case I have described, the causes which had given rise to the constriction in the sac had also effected alteration of structure in that part of it below the stricture, and thus gave rise to greater embarrassment in the operation. What these causes were, and how they had acted in producing these effects, are, I think, obvious from the history of the case. The man, when first affected with a small inguinal hernia, had worn a truss, and continued its use for many years. The effect which this would have by its continued pressure in causing constriction of the neck of the small sac, where it lay opposite the external ring, and also in condensing and altering the structure of its whole surface generally, will, I think, be readily admitted. After a time the use of the truss was discontinued, and the result was that a larger hernial protrusion took place, not entering into the original sac, owing to the narrowness of its opening at the contracted neck, but carrying along with it a fresh portion of peritoneum, and pushing the small sac down before it into the scrotum. So long as matters remained in this state the patient could always reduce it himself; but on this one unfortunate occasion, a part of the bowel had passed through the contracted part into the lower division of the sac (or into what was the sac of the original small hernia). This was the state of parts when the operation was performed. The upper part of the sac was opened, and part of the intestines returned, when a small tumour was brought into view closely connected with the scrotum; and now came the embarrassment, for there was no appearance of continuity between this and the superior part of the sac, owing to the tightness of the contraction; it was also totally different in appearance, and to the touch. Here, I think, it will be allowed that this was much more embarrassing than the cases of congenital hernia, where the lower part, or tunica vaginalis, unaltered in structure, would be more easily recognised, and where, from the relative position of the testicle, further assistance in diagnosis might be gained. Indeed,

I confess that the only thing which decided my action in this case was the practical consideration that whatever the thick fleshy substance surrounding the intestine might be, it was evidently strangulating it, and therefore equally evident that its constricting edges must be divided to relieve the strangulation.

We must now consider those points in the case which may assist us in our diagnosis, and regulate our operative measures in similar cases. The diagnostic marks of most value were those derived from examination of the swelling, and the feeling of it when trying to reduce it by taxis; for, although it presented at first sight the usual uniform appearance of a large scrotal hernia, yet a small "hard lump" could be felt at its lower part, distinct from the rest, and on attempting reduction all the contents of the sac could be returned, except this "lump," which the patient, who had hitherto been in the habit of reducing the swelling himself, at once stated he had never felt there before. Attention to these points, connecting them with the history of the case already mentioned under the former head, when speaking of the position and peculiarities of the stricture on the sac, would, I think, lead the surgeon to discover the true character of the case, before proceeding to operate; and then the question arises, How should such knowledge modify our plan of operation? Should we cut down upon the small swelling at the lower part of the scrotum, divide the constricted part of the sac, and reduce the bowel, without interfering with the upper division of the sac at all? I do not think this would be a very judicious plan; for, in the first place, the lower part of the scrotum is not the most favourable place for incisions; and further, we may have obstacles to the reduction of the hernia situated higher up, and if we require to divide them also, then our incision would extend through nearly the whole length of the scrotum, up to the inguinal ring, a thing always to be avoided. I should for my own part, if I altered my mode at all in a similar case, reduce as much as possible of the hernia before proceeding to the operation, and this would bring the reducible portion, or smaller division of the sac, up towards the inguinal region and upper part of the scrotum, and then the incisions might be made in the usual manner; only we must recollect that the contents of the larger or superior division of the sac having been reduced, the smaller or lower portion would necessarily become invaginated within it, so that more than one layer of serous membrane would be divided before the strangulated intestine would be exposed.

CASE II.—SCROTAL HERNIA, APPARENTLY REDUCED BY TAXIS. SMALL HERNIAL TUMOUR FELT AT UPPER PART OF CANAL; OPERATION; DEATH.

Mr. C., *æt.* 85, was seized with the symptoms of strangulated hernia on the 23d December 1853. He was seen by Dr. Cruickshank of North Berwick, who found a large scrotal hernia which the patient stated he had had for upwards of twenty years, but that it had never troubled him, as he could always reduce it. Dr. C. returned the tumour apparently by the taxis, but

the symptoms still continuing, he asked me to meet him to examine the case. I visited the patient on the afternoon of the 27th, and found him restless and suffering from hiccough. I was informed that the vomiting had not been so bad for some hours, and that he had had a slight motion of the bowels after an enema. The abdomen was tense and painful to the touch; there was, however, no distinct appearance of hernial swelling, but merely a general fulness from great development of fat on both inguinal regions. On examining the left side where the large scrotal hernia had existed, by passing my finger from below upwards along the cord, I thought I could detect a small swelling at the upper part of the canal. After again examining him, and feeling more satisfied as to the existence of the small swelling, I explained to his friends the necessity of an operation to afford him the only chance of relief, although, from his exhausted state and advanced age, the case was very unfavourable.

He had previously suffered from acute rheumatism and asthma, and on trying to administer chloroform it so depressed his pulse that its use could not be continued.

An incision was made, beginning well over the position of the deep ring, and carried down for about $2\frac{1}{2}$ or 3 inches. A very great depth of fat required to be divided in order to reach the tendon of the external oblique. I then slit up the tendon from the external ring so as to expose the canal, and when this was done I brought into view a small hernial tumour, about the size of a walnut, constricted at the deep ring. The sac was cautiously opened, as there was no fluid in it. The bowel was found very red and granular, but not very dark, and it presented no appearance of gangrene. The constriction was then divided directly upwards. I next gently drew down the gut to examine it immediately above the stricture, when I found a small firm band of lymph constricting it within the sac. This I also divided, then readily returned the bowel, and dressed and bandaged the wound in the usual manner.

I did not see the patient again, but I learned from Dr. Cruickshank that after a temporary relief the symptoms of vomiting and hiccough returned, with abdominal tenderness, and the patient gradually sank and died on the 30th of December.

Remarks.—In this case the doubt as to the existence of any portion of hernia being down, together with a deceptive remission of the symptoms, rendered it much more difficult to decide as to operating. The hernia, originally a large scrotal one, had been reduced by Dr. Cruickshank, with a distinct gurgling sound, of which the patient was sensible. There was also for a day some remission of the symptoms, and a slight stool. These circumstances, taken in conjunction with the absence of any apparent swelling in the inguinal region, when compared with that of the opposite side, or by examining the surface of the abdomen with the fingers, seemed to prove that the hernia had been reduced, and from its large size it could not have been reduced "*en bloc*." On the other hand, though there had been some remission of vomiting, still there was not that relief which follows complete reduction by taxis. There were the quick pulse, hiccough, clammy sweats, abdominal tenderness, tympanitis, and occasional vomiting on taking liquids; and the mere remission of the vomiting is by no means uncommon in cases of strangulated hernia. The most deceptive symptom to my view was the character of the stool; it was scanty, but liquid and bilious-looking,

as if from the upper part of the intestinal canal; and this in conjunction with the statement that several distending enemata had been given, which came away without any feculent matter, whilst the thin stool had been passed after the patient had taken some medicine by the mouth, I confess somewhat staggered my decision at first, but after several careful examinations of the dilated inguinal canal by my finger introduced along the cord, I was sure I felt a small swelling very deep, and too tense to be merely a part of the sac, and therefore, after explaining the necessity of giving the patient a chance of relief, I operated, and as it proved, the state of matters justified my decision. In a younger person there would have been less room for hesitation, because in such a case the mere incision, even supposing no hernia had been found, would not have been dangerous.

Besides the difficulties of diagnosis, there is another point of interest in Mr. C.'s case—the peculiar cause of strangulation of the small knuckle of bowel. When the great mass of the hernial contents was reduced by taxis, what prevented the return of this small portion? Before operating, I thought it might depend on a double constriction in the sac, similar to that in the preceding case of P. B. But on opening the sac the true cause was explained by the presence of a band of lymph constricting the loop of bowel—in fact, an internal strangulation within the hernial sac, keeping the constricted portion distended, leading to its further strangulation by the neck of the sac at the deep ring, and so preventing reduction. The occurrence of such cases has sometimes been argued against the extra-peritoneal operation for hernia, as it has been said that we cannot be certain in any case that such an internal constriction may not be present. But if we pay attention to the rule to make sure of being able to return the contents of the sac without forcible pressure, and take care not to push the sac and its contents back *en masse*, we may feel satisfied there is no such constriction. For although in this case not only all constriction external to the sac was divided, but even the neck of the sac itself, the knuckle of bowel still remained tense, and could only have been reduced by forcible pressure, if at all, and therefore I believe that the objection is groundless, inasmuch as division of the textures external to the sac would not permit of reduction, and thus the surgeon would be necessitated to open the sac, and so recognise the true nature of the case.

CASE III.—FEMORAL HERNIA. IRREGULAR ORTURATOR ARTERY CONSTRICTING THE INTESTINE.

In the history of this case I have purposely been most particular in detailing minutely every point connected with the operation, so that the practice resorted to, the reasons for its adoption, and the remarks which follow may be perfectly understood.

Archibald H., æt. 49, the subject of the present communication, had been under treatment in the medical wards of the Infirmary for some time, on account of severe chronic bronchitis and skin disease. He had suffered from femoral hernia for many years, which he had always hitherto been

able to reduce by taxis, although often with considerable success. On the evening of the 17th of March, I was requested by the resident surgeon to see the patient, as the hernia had come down suddenly about six hours previously, during a fit of coughing, was of larger size than usual, and had resisted the efforts made to reduce it, whilst vomiting, together with pain and tension in the swelling, had supervened. The resident physician informed me that he had tried the taxis as on former occasions, and that failing, it had also been fully tried whilst the patient was under chloroform by one of the resident surgeons, but without success; I learnt, moreover, that the patient had been making constant but unavailing efforts to reduce it himself. I found him vomiting, complaining of pain in the abdomen, and with an anxious expression of countenance. The hernia, which was a femoral one, about the size of a large orange, was tense, and painful on pressure. I had him put under the influence of chloroform, and judging from the state of the swelling and the previous efforts for reduction, that it would be better not to persist too much in the taxis, merely made a slight trial, and failing in that, proceeded to operate. I divided the integuments over the hernia, as I usually do, by a T incision, but owing to the depth of the fat and the bulk of the tumour, converted it into a crucial incision to gain more room. The superficial fascia having been divided so as to expose the tumour, was seen to be of a somewhat irregular form on the surface. On drawing the body of the swelling downwards, the falciform edge was seen, with the neck of the hernia very deeply situated. The fasciæ immediately covering the sac were next cautiously cut through, and a small flat director was insinuated beneath the margin of the falciform edge, which was notched with the bistoury sufficiently to enable me to use the point of my finger to guide the knife in dividing the deeper constriction. On pressing my finger upwards, I became sensible of the indistinct pulsation of a vessel close to the constriction, and therefore only made a very slight notch upwards and inwards, and another directly upwards, so as to divide the stricture at two points of its circumference. This enabled me to get the point of my finger so far below the crural arch as to push the vessel upwards and divide the arch to a sufficient extent to allow of the reduction of an ordinary hernia. I then scratched through a few fibres lying immediately on the neck of the sac, and attempted reduction without opening it, but unsuccessfully. I made the less effort to do this, as the hernial contents, as seen through the thin sac, seemed exceedingly dark and tense. I therefore opened the sac, and gave vent to a quantity of dark bloody serum, and exposed a portion of intestine (the cœcum), tense, and almost black from ecchymosis. Anxious to avoid, as far as possible, any further pressure on the bowel, I again enlarged the division of the ring sufficiently to enable me to introduce my finger, and also to draw down and examine the portion of intestine immediately above the stricture: I now found the contents of the sac to consist of the cœcum and the lower portion of the ileum; the latter was at once easily reduced, but the cœcum, from its form and connections, could not be so readily returned, and as, on examining it, I found a small portion of its peritoneal and muscular coats had been lacerated by the attempts at taxis, I thought it safest to make a still freer opening by dividing Poupart's ligament completely. With this view the cord was drawn upwards with a blunt hook, and I carefully dissected through the lower part of the tendon of the external oblique in a line corresponding to the centre of the femoral ring. Having fairly divided the superimposed textures, I found that there was still some constriction higher up preventing the gut being returned, and which kept it tense. On passing my finger up I felt a tight cord-like substance encircling

the nerves external to the sac, and recollecting the vessel I had felt pulsating, I at once concluded this must be the irregular obturator, whilst from the bulk, distension, and state of the protruded gut, it was equally evident that the constricting cord must be divided to permit safe reduction. Accordingly, keeping the finger of my left hand within the sac, as a guide to the constricting vessel, I used the forefinger of my right hand so as to hook it down, and brought it distinctly into view. The vessel was tied with two ligatures, and divided between them, the gut reduced, and the wound dressed and bandaged in the usual way.

I ordered an opiate to be given, and directed leeches to be applied at once, in case any symptoms of peritonitis supervened. Next day the pulse had risen to 120, and there was pain in the abdomen, and vomiting. Fifteen leeches were applied, and a pill, composed of 2 grs. of calomel and $\frac{1}{2}$ gr. of opium, was given every four hours. On the 20th the abdominal tenderness and the vomiting were less, but as the bowels had not yet been moved an asafetida enema was administered. This produced no satisfactory evacuations. A large distending enema on the 21st also failed to open the bowels, a dose of castor-oil was therefore given on the evening of the 22d, and on the morning of the 23d, after another large enema of warm water, a very considerable feculent evacuation took place, with great relief. On the 24th his general appearance was better, the pulse had fallen to 100, and the abdominal tenderness now complained of was confined to the lower part of the abdomen, and evidently due to inflammation and threatened suppuration in the abdominal parietes. He could retain food without vomiting, and was ordered chicken soup and some port wine. He was weaker and restless on the 26th. There was considerable pain and tension at one part of the abdominal parietes, and it was thought advisable to make an incision, in case of purulent matter being confined; but the incision, though carried deeply, did not open any purulent collection. A poultice was directed to be applied. The patient continued much the same till towards the morning of the 27th, when he became worse, sank rather suddenly, and died at 11 A.M.

Post-mortem Examination.—On opening the abdomen there were found the marks of acute peritonitis, but in a great measure limited to the right iliac and pelvic regions; lymph was effused upon the surface of the intestines, and there was a small quantity of turbid serum in the pelvis. The cæcum had regained nearly its normal position and appearance, retaining only slight traces of ecchymosis; the abraded part of its peritoneal and muscular coats, however, was as distinct as when first seen during the operation, and no attempts at plastic reparation seemed to have taken place; the lower parts of the ileum were also free, except a portion about three inches in length, which was thickened, and adherent to the parietal peritoneum in the neighbourhood of the wound.

Before making any further dissection I inserted a pipe into the right common iliac artery, and throw in some injection to distend the vessels, so as to be able to examine them more carefully afterwards.

On examining the swollen parts of the abdominal parietes, the muscular tissue was found generally thickened, and of a dense brawn-like consistence; whilst the substance of the rectus and oblique muscles was studded with numerous small collections of pus of a dirty gray colour, and which seemed infiltrated into their texture, not escaping readily when the collections were opened. There was also a considerable diffuse abscess in the sub-peritoneal cellular tissue on the right side of the bladder, at some distance from the wound. The parts more immediately concerned in the operation were removed for further examination.

On careful dissection, I found, as might have been expected from the laparotomy, that the parts were considerably matted by plastic effusion. On dissecting from without I found the whole of the falciform process, together with the lower border of the tendon of the external oblique, fairly divided, and the spermatic cord and its investments laid bare, leaving, even after the contraction consequent on the healing process, a very free opening.

Dissecting from within, I found the epigastric artery of a large size, and the obturator arising from it; this latter vessel was obliterated to some extent, and diminished in size, from the effects of the ligature. The ligature on its proximal end had not separated, that on the distal end had; but the injection had entered the distal portion by the anastomosing vessels, so that the course of the artery round the opening through which the hernia passed, can be readily traced in the preparation; a sketch of which is subjoined (see plate XXXVI.) It arises from the epigastric before that vessel has ascended on the parietes, creeps slightly upwards on the outer side of the femoral ring, then curves closely around its upper border, and finally descends along its inner side to gain the obturator foramen, so as to encircle the opening at all points available for division with the knife.

I learn from Mr. Edwards, one of the demonstrators in the University, that the artery was also irregular on the opposite side,—where the epigastric arose from the common femoral, passed upwards in front of the femoral vein, and, on reaching the abdominal parietes, gave off the obturator so as to surround the upper part of the crural ring; unfortunately, however, the dissection has not been preserved.

Remarks.—This case is, I believe, unique in one respect, being, as far as I can learn, the only one in which the presence of the artery has been ascertained during the operation, and avoided in incising the ordinary seat of constriction; whilst its ligature and division were ultimately necessitated from the vessel itself being the obstacle to reduction.

But I think it principally worthy of being detailed, as it seems to me to show practically that in cases of femoral hernia, where the irregular vessel exists, its presence may be ascertained, and the constricting portion of the crural ring may be sufficiently divided to admit of reduction without wounding the irregular vessel, if certain precautions be adopted; and, secondly, when complications may necessitate or endanger its division, it shows that the vessel may be tied, and what the plan of procedure in such cases ought to be.

First, then, as to the risk and chance of avoiding injury in ordinary cases of femoral hernia.

I will not enter into anatomical details further than to say that there are three different positions in which we find the obturator artery placed in relation to the femoral ring, when it arises by a common trunk with the epigastric—viz. 1st. Descending closely applied upon the external iliac vein, to reach the obturator foramen, and hence lying to the outside of, or behind and to the outside of, a femoral hernia, and therefore out of all risk of injury during the operation. 2d. Passing down from the epigastric towards the obturator foramen—farther removed from the vein, so as to divide the femoral ring into two sections, in which case it might be either pushed aside, or stretched in front of a hernial protrusion, or, as in a case described by the late

Mr. Allan Burns, have two small hernial protrusions, one on either side of it. 3d. The artery arising from the epigastric passes upwards, then curves round the upper, and descends along the inner margin of the femoral ring to gain the obturator foramen, so as to encircle a hernia passing out at the femoral opening, in all the directions available for incision. It is to this last irregularity I would at present direct attention. As regards the statistics of this form of irregularity there is considerable discrepancy, some authorities, as Mr. Quain, stating it at nearly 1 in 10; Velpeau, 1 in 15; and Monro, 1 in 20 or 25. It is evident, however, that practically no matter how rare or frequent such an irregularity may be, the surgeon can never predict in what case he may meet with it, and is therefore bound to act in every case with the same caution as if it were present.

This arterial irregularity, as coincident with a femoral hernia, must be, of course, still more rare, yet there are several such cases on record.

There is a preparation in the Barclay department of the Museum of the Edinburgh College of Surgeons, showing such a coincidence; and the late Mr. Liston had one in his museum. In at least two cases the artery has been wounded during the operation for strangulated femoral hernia; once in a case operated on by Baron Dupuytren, where its division was only discovered after the patient's death from other causes. The other case occurred to Mr. Skey of St. Bartholomew's; in it the bleeding was profuse at the time, the lower end of the artery was tied, the upper could not be secured, but bleeding was arrested by other means, for the patient only died some days afterwards from the effects of a drastic purgative given by mistake. Lastly, in a case which occurred to the late Dr. Richard Mackenzie, it was found, on the patient's death some weeks after the operation, that the irregular obturator had encircled the neck of the sac, but had escaped division. (See fig. 212 at p. 1034.)

Now these cases show that the artery has been accidentally cut, and also accidentally avoided; but the case I have recorded goes a step farther, for it shows that the surgeon, by proceeding cautiously, and feeling with the pulp of his finger before dividing the constriction formed by the deeper or higher portion of the crural arch, may detect the presence of the irregular vessel, and then, by cautiously notching the constriction, to a very slight extent, at two points of its circumference, he will gain room sufficient to enable him, either with his nail or the point of a small flat director, to push the artery out of the way, while he divides the stricture more fully.

By following this plan, I was enabled to relieve the constriction, so far as to draw down and examine the intestines contained in the sac, and readily to reduce the portion of the ileum, so that, under ordinary circumstances, no further incision would have been necessary, and the vessel would have remained intact.

Of course, if the operator holds the opinion that the whole thickness of the crural arch, including Poupart's ligament, ought to be divided in every case, then the irregular vessel runs a much greater risk than if he limits his incision to the division of that portion of the arch formed by the convergence of the abdominal fasciæ below Poupart's ligament,

which immediately constricts the sac, and which is all that I have almost ever found it necessary to divide in cases of femoral hernia.

Second. The case, however, shows that certain complications, occurring in a femoral hernia where the irregular obturator artery was present, might render it necessary to divide the surrounding textures so freely, for the purpose of reducing the protrusion, that there would be very great risk of wounding the vessel; or that, from the artery tightly surrounding the protrusion, it may absolutely require to be divided, as itself an obstacle to reduction: And this leads us to the consideration of what these complications are, and how such difficulties may be best met and overcome.

Though I have mentioned the irregularity of the obturator artery as being an obvious and serious complication in the case, it was by no means that which gave rise to the greatest difficulty;—indeed, from my remarks under the first head, it may be seen that I hold that, except for the other conditions of the hernia, the irregular vessel would not have given rise to much difficulty, or been in much danger of being wounded.

The real difficulty which complicated the operation was, I think, the bulky and irregular form of the protruded cœcum; its comparatively fixed position, by its peritoneal attachments, near the site of the femoral opening; and its posterior cellular connections, not allowing it to slip back like a portion of the floating intestine; and last not least, the state of the bowel, from the previous attempts at the taxis, forbidding all further pressure or manipulation that could possibly be avoided.

The form and connections of the cœcum always render its reduction slow and gradual, even under more favourable circumstances, where the bowel can safely bear moderate compression, and where the constricting textures have been very freely divided,—as I found in a case of inguinal cœcal hernia on which I operated some time ago, where there was no limitation to making the incision of the constriction very free indeed; and I have also seen the same difficulty, though to a much less degree, in cases where the sigmoid flexure of the colon formed the contents of inguinal herniæ. In femoral hernia, however, where our incisions must, in general, be much more limited, and especially when we have ascertained the presence of an irregular artery round the upper part of the ring, the causes of difficulty I have alluded to become very embarrassing, and require us to adopt great caution in dividing the constricting textures. It was the eccentric pressure of the bulky distended gut which brought it into contact with structures which do not ordinarily form the seat of stricture, and in this way the irregular artery, dragged and stretched to the utmost by the distended portion of the cœcum, had come to form a cord-like constriction upon it, requiring division before the bowel could be returned.

As to the plan to be adopted in such cases of femoral hernia, requiring such free incisions to relieve the bowel, I can only say that, after much consideration of this case, I would still proceed to divide the superimposed textures by the same method—viz. by dissecting cautiously through the lower division of the tendon of the external oblique, and the other textures, down to the peritoneum, in a line cor-

responding to the centre of the femoral ring, the cord being drawn aside. Thus all danger of wounding the artery accidentally is avoided, and if it be found itself constricting the swelling, it will not be found very difficult to bring it into view and put ligatures upon it.

This plan is that which Sir Astley Cooper recommended as safest and best in all cases of large femoral hernia; and although I cannot think, after some experience in femoral herniæ, that it is either necessary or advisable as a general plan, it will be found the safest in complicated cases requiring more than usually extensive incisions; it is, in fact, a cautious dissection down upon the upper part of the sac, or the parietal peritoneum immediately above and continuous with it, and if carefully conducted, is attended neither with difficulty nor danger.

IV.—GROUP OF CASES OF HERNIA.

(From Clinical Report for 1860-1.)

1. Mary Stark, æt. 43. A femoral hernia first came down ten days previous to admission. Taxis twice applied by her medical attendant; bowels had not been opened up to the date of her admission into hospital, when she was suffering from well-marked symptoms of strangulated femoral hernia. The operation was immediately performed, and the bowel was found perfectly black, with grayish patches, and had a distinctly gangrenous odour. The constriction being divided, the bowel was not returned into the abdominal cavity. An opiate was administered, and a poultice applied to the wound. Ordered calomel and opium pills every fourth hour. Bowels opened next day. Patient died on the third day after admission.

2. Janet Dalziel, æt. 71. Strangulated femoral hernia. Symptoms existed for five days. Sac opened. Bowel returned. Cured.

3. Catherine Reilley, æt. 32. Strangulated femoral hernia. Down thirty-six hours. Sac opened. Bowel returned. Cured.

4. Mrs. Notman. Had been troubled with an oblique inguinal hernia for six years, which, however, was always readily reduced, with the exception of a small part which never could be kept up. On the day previous to admission into hospital it had again come down, and she had experienced severe twisting pain in the umbilical region, together with nausea and vomiting, which, on the following day, became stercoraceous, when she was at once sent to hospital. On examination it was found that, in addition to the hernial protrusion of left side, there existed directly over the crural canal of the right side a hard, isolated, prominent, and well-defined swelling, about the size of a walnut, which patient stated had commenced a year ago, and gradually enlarged. The protrusion on the opposite side could be easily returned within the external ring; but doubts being entertained as to its complete reduction, it was cut down upon, and a constriction was found to exist at the upper part of the canal. The bowel was returned, and a distending injection given immediately after the operation, which brought away a large quantity of bilious-looking fæces. Hernial symptoms were now quite relieved; but the patient suffered from severe bronchitis, and for some years past she had been affected with cancer of the os uteri. The hernial wound healed rapidly; but the patient died three months afterwards from the cancer of the womb and bronchitis.

5. Janet Patterson, æt. 40. Strangulated femoral hernia. Down thirty-six hours. Sac opened. Bowel claret-coloured, but not gangrenous. Cured.

6. Catherine Duncan, æt. 34, wife of gardener, Loanhead. Femoral hernia. Admitted 30th September. Hernia frequently down during the fifteen months before admission. For a month before admission almost continuously down. About 7 o'clock on 30th September bowels were moved. At 8 o'clock felt pain in lower part of abdomen. At this time the tumour had increased to the size of a pigeon's egg. She became sick and vomited phlegm. Never felt twisting sensation at umbilicus. She, along with a female friend, persevered for nearly two hours in trying to reduce the swelling. It then became as large as a small hen egg. At 1 o'clock Mr. Spence tried the taxis. Ordered a distending injection, and cold to be applied to tumour. No fæces came with injection. At 6.30 p.m. Mr. Spence operated. The bowel very black, but no gangrenous odour. It was returned, and the wound closed. After the operation everything proceeded favourably, except that some irritation caused by flatulence existed during the first few days.

CONGENITAL INGUINAL HERNIA.

7. Charles Mason, æt. 19, was admitted on the 4th October last, labouring under a strangulated congenital hernia. The hernia had come down suddenly that morning; and after its descent he had suffered from severe pain in the swelling, tenderness of abdomen, and vomiting. Previous to admission antimonials had been given, and the taxis twice tried under chloroform. On admission, after a distending enema had been administered, and cold applied to the swelling, the patient was put under chloroform, and the operation performed. About a foot of small intestine of a deep chocolate colour was found in the sac, and returned. A large opiate was ordered.

Post-mortem appearances.—About a foot of bowel quite black and suppurating on the serous surface. Submucous tissue highly congested.

FEMORAL HERNIA. EXTRA-PERITONEAL OPERATION.

8. Helen Steele, æt. 36. On admission, stated that she had been afflicted with a hernia for the last ten years, and that she always wore a truss, but neglected on Sunday morning to apply it. About 9 a.m. she suddenly felt a severe pain in the right groin, and found that she was not able to reduce the swelling as she usually could do. A surgeon was called in, whose efforts to reduce it by taxis, without the aid of chloroform, were unavailing. She came to the Infirmary about 7.30 p.m. Mr. Spence performed the extra-peritoneal operation, and the patient made a very rapid recovery.

Remarks on the Cases of Hernia.—The group of cases presented in this Report is of very considerable interest, for it furnishes, in small compass, examples of some of the most important conditions met with in strangulated hernia, and the plan of treatment adapted for each.

The first case, that of Mary Stark, is an example of the bad effects of delay, permitting the incarceration to proceed to complete strangulation and gangrene. The case in fact had been treated for constipation in the first instance, and active purgatives administered before the hernia was discovered. Then the taxis was tried ineffectually. I was then requested to see the patient, and urged her to have the operation performed; but both she and her friends refused, and another day was lost before she came into hospital.

Her condition was then very hopeless ; her pulse was weak and intermitting, and she had stercoraceous vomiting and constant hiccough ; but as the operation was the only chance for life I performed it. After the division of the stricture I drew down the gangrenous portion, but did not open till after some hours, when lymph had become effused ; so as to diminish the risk of extravasation of feces into the abdomen. I then opened it freely, and there were feculent evacuations both by the wound and by the anus. The operation afforded great relief to the general symptoms, the vomiting ceased, and the pulse became firmer for a time, but this reaction soon ceased, and she gradually sank. I believe, from the slow progress of the symptoms, that had this patient been operated on even a few days earlier, there can be little doubt the result would have been as favourable as in the case of Mrs. Dalziel ; and I think medical men can hardly be too much impressed with the necessity for careful examination, in all cases of obstinate constipation, lest a hernia be overlooked. The reason I did not at once open the gangrenous part of the intestine arose from having observed that in cases where this has been done immediately, the patients often sink very rapidly, with great increase of abdominal pain ; and I believe this is due to some of the thin feculent matter oozing back through the divided constriction into the abdomen. Freely dividing the constriction, drawing down the gangrenous part, and applying warm-water dressing, or a soft poultice, for a few hours before opening the gut, diminish this risk ; and I have for some time adopted this in my practice as a general rule.

The cases 2 and 5 were cases in both of which the strangulated intestine had suffered to the extent of threatened gangrene in the protruded knuckle. In the case of Mrs. Dalziel, an old woman above 70, the rupture had been down five days, but as the symptoms did not become urgent till thirty hours before admission, she had not applied for medical aid. In Patterson's case, the symptoms had proceeded rapidly, and become very urgent in less than thirty hours. In both, the small portion of intestine in the sac was tightly constricted, of a dark claret colour, and mottled with gray spots ; but the intestine above the constriction was healthy, and not distended or inflamed. In cases of this kind I adopted the practice I followed in these cases, viz. of dividing the stricture very freely, gently replacing the intestine within the margin of the ring, but leaving the dark part visible, and the wound open, and merely placing a fold of lint soaked in warm water over the wound, retained by a single turn of a bandage. Thus, if sphacelation or ulceration of the dark portion of the gut does occur, the feces pass out at the wound, and this gradually diminishes, and ultimately the feculent fistula closes completely ; whilst in other cases the gut regains its vitality when the stricture has been relieved, and the case, as in the instance of Mrs. Dalziel, goes on uninterruptedly to a cure by contraction and granulation. In most cases, if a feculent fistula is to form, it begins to show itself between the sixth and eighth day ; but in Patterson, the wound, though carefully watched and dressed in expectation of a fistula forming, seemed to heal well, though slowly, and after eight weeks she left the hospital wearing a truss. Some weeks afterwards a small abscess formed, and then small quantities of thin feces occasionally passed ; but now the fistula is almost entirely healed. I have never seen that condition occur so long after the operation in any other case, and I think it is most likely that the pressure of the truss not carefully applied had caused irritation and abscess under the cicatrix, which may have perforated the adjacent bowel.

Mrs. Notman's case (4) is a very instructive one, as exhibiting the difficulties which often complicate our diagnosis in cases of hernia ; and as it was impossible in the abstract of the case to give a full idea of these, I think it

well to draw attention to them. The abstract of her case states briefly the facts observed on admission, viz. that along with symptoms of strangulation, there existed in the left inguinal region a cyst-like swelling, globular, and not painful, easily pushed back within the lower part of the canal, but reappearing whenever the pressure was removed. She stated that this swelling was always present, but that sometimes a larger swelling came down; and that could be felt high up in the canal was an undefined hardness near the deep ring. In the right inguino-femoral region there existed a swelling about the size of a walnut, hard, but elastic at the most prominent part, tender to the touch, and occupying exactly the position of a femoral hernia. Looking at these local conditions in conjunction with the symptoms, everything would have favoured the idea that the swelling in the femoral region was most likely to be the seat of strangulation. Fortunately, however, I knew something of her case; for about a year previously she had consulted me about the swelling in the right groin, supposing it was a rupture. The stony hardness of the tumour at that time, and the general cachectic look of the woman, left no doubt on my mind that it was a cancerous gland, probably connected with malignant disease of the uterus; which opinion was confirmed by examination with the speculum, showing decided cancerous affection of the os uteri. Hence, when I now felt the elastic swelling, I at once concluded that the elasticity was due to the progress of softening, and not to any portion of gut protruded behind the swelling. But, on the other hand, there was little doubt in my mind that the round cyst-like swelling did not contain strangulated intestine, for there was no continuous neck to be felt: it was quite defined and globular. The hardness and tenderness at the position of the deep inguinal ring was what appeared to me the suspicious point. I accordingly explained to the students present that I would cut down upon and lay open the inguinal canal, and expose the deep ring fully, in hopes of finding a portion of strangulated intestine there, but that, if nothing was found there, then I would (however unwilling) consider it my duty to cut down upon the cancerous mass in the femoral region, in case a small hernia might have descended and be strangulated behind it, as the urgent symptoms were unmistakably those of strangulation. On laying open the left inguinal canal, I found, as I suspected, a very small knuckle of intestine, tightly constricted by the neck of the sac, the constriction appearing to proceed upwards within the deep ring; this was cautiously divided, and the gut gently examined and returned. I now found the globular cyst lying loose in the lower part of the canal, and on tracing the opened sac downwards, I found it had evidently at one time formed a part of it, as, though I could not press out the contents of the cyst, there was a minute opening of communication, which admitted an Anel's probe. I laid the cyst freely open and evacuated its serous contents, and then dressed the patient in the usual manner.

The line of practice followed in this case seems to me the proper treatment under similar circumstances. I think it important always to bear in mind, that although we may from previous knowledge be sure that a tumour (such as that in the right groin in this case) occupying the position of hernia is really glandular or cystic, yet, if at any time symptoms of strangulation occur, we should recollect the possibility of hernial descent taking place behind it, and act accordingly.

The case of the lad Mason is valuable as illustrative of the dangers peculiar to the congenital form of inguinal hernia, and also as it serves to direct attention to some dangers connected with the treatment resorted to, to facilitate reduction by taxis.

The cases of *Railley*, *Duncan*, and *Steele* (3, 6, and 8) were ordinary cases of strangulated femoral hernia, where the strangulation had not existed very long. In the first two the sac was opened, because from the one hernia having been down thirty-six hours, and the other having been subjected to violent attempts at reduction by the patient and her neighbours, I had doubts as to the state of the contents of the sac. Whilst in the last case, that of *Mrs. Steele*, the hernia being quite recent, no undue violence having been used, and the constriction evidently caused by the textures external to the sac, there was no reason for doing more than dividing these, emptying the sac of its contents, and then invaginating it.

DISEASES OF INTESTINES.

CASE OF INTESTINAL OBSTRUCTION—GASTROTOMY.

Margaret Nicholson, æt. 66, single, stocking-worker. Admitted into bed in Ward XI. (medical), Royal Infirmary, March 22d, 1871.

History of Present Illness.—About seven weeks ago patient got a mixture for her cough, which had the effect of causing constipation. Her bowels gradually became so torpid that they were never moved above once a week, and then only by the use of laxatives. A fortnight previous to her admission aperients failed to relieve the bowels, and the patient began to get sick and vomit. Three days ago her abdomen began to swell, and the vomiting became constant. Vomittings were not fecal. During this fortnight she has had constant desire to empty the bowel, but nothing came away but a slimy mucus.

The patient had previously suffered from prolapsus uteri, for which an operation was performed by Dr. Keiller. Before the swelling of abdomen commenced, patient says she had a bulging out of the abdomen about the size of her two fists, just below and to the left of the umbilicus.

CONDITION.—On admission, *March 22d*, patient has not an anxious expression nor a cachectic look.

Abdomen is swollen, especially below umbilicus, and in both inguinal and lumbar regions on both sides, slightly more in right than in left. Tenderness in right hypochondrium. No hard lump or tumour can be felt. The whole of the swelling is tympanitic, only the note is impaired in a space $1\frac{1}{2}$ inch square, just below and to the left of the umbilicus.

TREATMENT.—Enema of castor-oil, etc., was tried, but without effect.

March 23d.—Abdomen as above. Examination per rectum discovered a rounded firm mass projecting into the canal $2\frac{3}{4}$ inches from the anus. Canal not blocked up; finger can be passed beyond the tumour. Nothing felt higher up the rectum. Per vaginam, same tumour felt, but relations to uterus not determined upon. Uterus seemed displaced.

March 24th.—Abdomen more distended in cæcal region, forming a projection about size of a coco-nut, which becomes diffused into general swelling. Still tympanitic note, especially clear in course of large intestine, except in left lumbar region, which is not so markedly distended. Friction can be felt and heard in upper part of right lumbar region. Great tenderness there.

Injection of water tried, but only 10 oz. could be thrown up. Repeated several times, but brought nothing away. Rectal bougie could only be passed for $4\frac{3}{4}$ inches. When entered $2\frac{3}{4}$ inches it met with an obstacle, but this was passed by inclining its point backwards.

March 25th.—Abdomen more distended. Cæcal swelling continues. Course of transverse colon distinct. Descending colon not so marked, and there is an absence of swelling both anteriorly and posteriorly at the site of splenic flexure of colon. Sigmoid flexure swollen and tympanitic. Professor Spence was called in. Examined the case, and confirmed previous observations. Tried to pass a tube and inject water, but results obtained similar to those of former attempts. Recommended injections to be again tried, which was done, but without effect.

March 26th.—Professor Spence, Professor Sanders, and Dr. Watson, consulted over the case. Colotomy in the left lumbar region posteriorly was suggested, but rejected on the ground of the absence of swelling at the sigmoid flexure; this raising the suspicion of an obstruction being at this point, or in the small intestine, Gastrotomy was determined upon, and performed by Professor Spence, with the assistance of Dr. Watson.

OPERATION. --A cloth having been bound round the abdomen, with an opening in the central line, Mr. Spence made a longitudinal incision through the integuments in the line of the linea alba, beginning about an inch below the umbilicus, and continued downwards for about $4\frac{1}{2}$ inches. The textures were carefully divided down to the peritoneum, and, after the bleeding points had been secured, the peritoneum was opened along the line of the incision. On this being done there appeared a coil of convolutions of the small intestines, some of them distended and congested, others quite flaccid. Partly overlapping and pressing on this mass there appeared an ovarian cyst about the size of a small melon. The convolutions of intestine, on being relieved and drawn up from under the tumour, presented at several points the appearance as of recent adhesions, and one portion was dark, thickened, and granular on its peritoneal surface, similar to what we see in some cases of strangled hernia. The flaccid convolutions were above this part. The ovarian cyst was punctured with a trocar and india-rubber tube, and the fluid drawn off, the pedicle transected and tied with double ligatures, and the tumour removed. On its removal a cystic and partly solid tumour of the left ovary was felt in the pelvis, the solid portion in close relation to the upper part of the rectum, and having connections by old adhesions. It was now thought advisable to extend the incision upwards to ascertain fully the state of the colon, and on this being done, it was seen to be contracted, but not constricted beyond its splenic curve. The ovarian tumour on the left side was now gently drawn upwards, and its adhesions separated as carefully as possible, and the pedicle secured and divided. On removing the tumour it was now found that the lower part of the colon, at its junction with the rectum, had been closely connected to the left ovarian tumour, and that there was a small aperture in its coats at the point where the adhesion had existed. The rectum was firmly tied below this aperture, and the gut divided and its open end brought to the surface. At first little or no feculent matter came away, until by uncoiling the small intestine and pressing the cæcum and transverse colon, the feculent contents of the intestines began to pass along the gut. The cavity of the pelvis was then carefully washed out, the viscera replaced, and the wound closed, with the exception of the lower part, at which the divided colon was brought and its edges carefully secured to the integuments by continuous suture. A piece of oiled lint was placed around the opening, and the patient placed in a position to favour the escape of the feculent matter. The woman, who was in a very exhausted state before the operation, rallied somewhat, but ultimately sank about midnight.

Remarks.—This case exemplifies the difficulties of diagnosis, and the complications which occur in cases of internal intestinal obstruction, and which render gastrotomy such a doubtful procedure. In this instance, whilst there were obvious causes of obstruction in the rectum, the principal obstruction was situated in the small intestines, and was caused by the coil of gut which had descended into the pelvis being so compressed between the two ovarian tumours that irritation had been excited, and recent adhesions had occurred.

LECTURE CVI.

INJURIES OF THE BLADDER AND URETHRA : their Dangers ; Treatment—Stone in the Bladder : Causes ; Symptoms—Diagnosis between it and other Diseases—Prognosis as to result of Operations, according to the Nature of the Concretion.

I NOW pass on to treat of the injuries and diseases of the pelvic viscera, commencing with those of the genito-urinary system.

INJURIES OF THE BLADDER OR URETHRA may occur as the result either of penetrating wound or of force directly applied ; or from indirect force in certain injuries of the pelvis. The most frequent site at which the urethra is wounded or lacerated is in the perineal portion of its course. In this position I have seen several cases of direct wound from persons falling on some sharp substance ; in some of the cases, in young children it occurred from the breaking of an earthen-ware chamber-pot. In these cases the wound attracted immediate attention and prompt treatment. The catheter was introduced at once, and retained for twenty-four or forty-eight hours, until the soft parts in the perineum were glazed with lymph, and then introduced occasionally from time to time until the wound finally closed, and also for some time subsequently, to prevent the contraction giving rise to stricture. All the cases of this kind which I have seen did well at the time ; but I have had to treat some of them in after years for very bad stricture, owing to their neglect of the occasional introduction of an instrument.

In such cases, when the superficial wound is small, or the soft parts over the wounded urethra imperfectly divided, I would advise the practice I have always adopted of dilating the wound freely in the line of the raphe of the perineum, to afford free outlet for the urine, pus, and sloughs of cellular tissue.

The urethra may also be lacerated without any external wound in the perineum, in consequence of the person falling astride a bar or rope, or from some similar accident ; or in consequence of indirect violence, as, for example, from a weight of earth falling on the lower part of the back when the person is stooping. Such an accident may cause more or less separation of the sacro-iliac synchondrosis, or even of the pubic symphysis, and the membranous portion of the urethra gives way at its inferior aspect. In all cases where we have injury of the pelvis, it is a wise precaution to pass a full-sized catheter at once, before the patient tries to make water, for unless this be done, if the urethra be ruptured, part of the urine will be extravasated into the tissues, and

give rise to infiltration of urine, with all its disastrous effects. In the cases where the urethra is ruptured from the person falling directly upon the perineum, there is generally bleeding from the orifice of the urethra, and extravasation of blood into the textures of the perineum. The latter condition is sometimes the cause of considerable difficulty in passing a catheter into the bladder, for the extravasated blood displaces and compresses the torn ends of the urethra, so that they no longer correspond.

The treatment in such injuries is to pass a gum-elastic catheter into the bladder at the very first, before much effusion of blood has occurred, as the catheter can then be generally passed with ease, if the point is kept bearing gently along the upper or lateral portion of the canal, so as to prevent its point passing through the laceration, which is almost invariably in the floor of the urethra.

When much blood is effused it requires great care and skill, by gentle and patient manipulations, to guide the catheter along the canal. So great indeed may be the difficulty that you may even require to incise the swollen perineum, to turn out the clots; and then, with the finger in the wound, guide the catheter onwards, or open the urethra further back. If the patient has attempted to pass his water, and there be much swelling in the perineum, an incision in the line of the raphe should be made at once, as the probability is that the urine will have been extravasated amongst the coagula, and unless it gets vent it will lead to very serious, if not fatal, consequences. In all such cases the catheter must be kept in the bladder for a day or two.

The urinary bladder in the adult is so placed in the pelvis as not to be exposed to much risk from penetrating wounds of the abdomen, unless these pass obliquely from before downwards and backwards, or unless the bladder be distended so as to have risen above the pubis at the time of the injury. In fractures of the pelvis, however, sharp projecting portions may perforate the viscus, or it may be torn by the force causing the injury. When the bladder is much distended it may be ruptured in consequence of the patient receiving a blow on the abdomen, or by his falling, or running against a post. In such circumstances the rupture usually takes place towards the posterior aspect of the superior fundus, and consequently the urine is effused into the peritoneal sac amongst the viscera. In other cases, where the blow has been received just above the pubis, the anterior wall of the distended viscus yields below the reflexion of the peritoneum, and then the urine is extravasated into the cellular tissue of the pelvis and iliac fossæ. In either case the injury is one that leaves small chance of recovery. In the rupture immediately above the pubis there is some slight chance of recovery if prompt treatment be adopted—by incising the integuments and linea alba at the lower part of the abdomen, whereby an outlet is afforded for the urine and sloughing cellular tissue, then introducing and retaining a vulcanised india-rubber catheter in the bladder, taking care to change it every second day, and at the same time watching the constitutional symptoms and supporting the patient's strength. Should an external wound exist it should be carefully enlarged and free drainage effected; washing out the bladder from

time to time with a weak carbolic lotion. Even in the case of rupture of the distended bladder into the peritoneum there is one case of recovery on record, regarding which, from the history of the case and the symptoms, I think no reasonable doubt can exist that the bladder was ruptured above the peritoneal reflexion. When this case was first published it was objected that, with the exception of the urine first drawn off, there was no bloody urine. But this is not wonderful, for the bladder, in its ordinary condition, is not very vascular. And as to matter of fact, in a case which I attended along with the late Dr. John Taylor of this city, and in which I drew off the urine with the catheter at the first, and subsequently, until the man's death, there was not even a tinge of blood in the urine, and yet the bladder had been fairly transfixed by a portion of the fractured pelvis.

It has been proposed that when the urine is effused into the peritoneal sac, the recto-vesical cul-de-sac of the peritoneum should be punctured by means of Pouteau's trocar, as it is supposed that the urine will naturally gravitate in that direction; but, in reality, the urine is effused amongst the viscera; and in the *post-mortem* examinations I have witnessed of patients who have died from such injuries, I have never seen any such amount of fluid in the inferior cul-de-sac of the peritoneum as would afford an indication for puncturing it. Beyond using the catheter, and treating the general symptoms, I fear we can do but little in these almost hopeless cases. (See case of ruptured bladder in Clinical Cases.)

DISEASES OF THE URINARY ORGANS.—*Examination of the Urine.*

1. In regard to certain diseased conditions and surgical operations, I have already drawn attention to the necessity for frequent and careful examination of the urine. In operations and diseases of the urinary organs the special necessity for such examination is very obvious, and I would here suggest the method or plan on which our investigations should proceed.

First, as a general rule the morning urine should be obtained before the patient has taken food, and the evening urine at a time when the digestive process may be supposed to be completed, and these specimens should be examined separately.

2. The chemical reaction, as regards acid or alkaline quality, is tested by means of blue and red litmus and yellow turmeric papers, the first showing acidity by rendering the blue litmus paper red, the rapidity of change and bright red marking roughly the intensity of the acidity. If the urine be alkaline the pink litmus test-paper becomes blue or purple, the turmeric paper brown. In some cases the pink litmus paper becomes blue when dipped in the urine, and then rapidly becomes red again when exposed to the air. The alkaline reaction is then due to the ammoniacal character of the urine. These tests should be applied to recently passed urine, or, better still, whilst it is being passed or drawn off. They form the primary or immediate tests. The specific gravity of the urine should also be taken immediately, if possible, whilst the urine is of its normal temperature, although for practical purposes that is not very important. A portion of the urine is set aside in a well-corked tube

or phial, or a vessel closed by a layer of cotton wool, for further examination by the microscope and chemical tests. In regard to the specific gravity, we should bear in mind that the condition is relative. Thus in a perfectly healthy person, in warm weather or after active exertion, and who has not drunk much fluid, the urine will be concentrated and of higher specific gravity; whilst if a person is drinking water freely and passing a large quantity of urine, it is diluted, and may be of low specific gravity. Hence it is important to ascertain the amount passed during twenty-four hours to get the true significance of the specific gravity. It is also necessary in combination with tests for other purposes.

In surgical practice, for example, a patient consults the surgeon for *irritable bladder*. He may be of an age when there is likely to be enlargement of the prostate, and he complains of increasing frequency in micturition, and the surgeon may be thrown off his guard. The patient dwells on the frequent calls to pass water, the inconvenience of which attracts his attention, and does not notice that he also passes a larger quantity of urine. Instead of irritable bladder in the ordinary form, he is affected by glycosuria, or a form of Bright's disease, and hence the surgeon should always question not only as to frequency but as to the quantity passed, and also test the urine as to the presence of sugar or albumen. Then as to the subsequent examination of the urine, it must be tested for the presence of albumen, phosphates, oxalates, and uric acid, urates, sugar, etc.

Lastly, the sedimentary portion must be more leisurely examined under the microscope, to recognise the presence of the salts—whether phosphates, oxalates, or uric acid; and to determine the nature of the organic matter—whether pus globules, tube casts, and the character of the epithelial debris which may be present. Such methodical examination gives us most valuable assistance in the treatment of urinary disease, and should be carefully carried out in practice.

DISEASES OF THE BLADDER.—*Irritable and Inflamed Bladder.*

IRRITABLE BLADDER is characterised by frequent desire to pass water when there is very little urine in the bladder. There is generally pain felt along the urethra and at its orifice, or irritation at the lower part of rectum. The urine passed is generally high-coloured and concentrated, but may vary according to the cause of irritation, whether that be vesical or renal, or arising from sand in the urine, calculus, or gouty irritation. Irritable bladder is rather symptomatic of other diseased states of the urinary organs than a special disease. It is, when at all persistent, more due to inflammation, either acute or chronic. The desire to micturate is almost constant, only a small quantity being passed with great straining and with only temporary relief, for the desire to micturate returns rapidly. The treatment will depend on the cause in each case. Thus if it depend on exposure to cold and damp, and if the urine be concentrated and shows a strong acid reaction, with perhaps red sand (uric acid), then the best treatment is to use an opiate suppository, and to direct the patient to drink freely of aerated potash water, or distilled water. At the same time, attention must be given to the state of the digestive organs by careful regulation of diet and

by medicine. Warm fomentations should be applied to the abdomen, and sinapisms over the sacrum. In gouty patients the exhibition of colchicum in small doses (seven drops) twice or thrice a day with the aerated potash or lithia water is of great benefit, and the bromide of potash in camphor water is also very useful in allaying the irritable state. In cases of gouty irritable bladder in old or asthenic patients, the colchicum may be given in five-drop doses, combined with a grain dose of quinine twice a day. Thin linseed tea, decoction of triticum repens, and other bland diluents, also soothe the mucous membrane of the urinary track; but care must be taken to avoid over-distension or derangement of the stomach. In all cases in the early stage of such an attack, the use of the warm bath or the warm hip-bath is of great value.

In most cases, when the irritable state resists such treatment, it will generally be found that that condition is really symptomatic of inflammation either of the bladder itself or the prostate, or some disease of the kidney, or to the presence of a calculus, and then, of course, the treatment must be varied according to the conditions present.

One of the most common causes of irritable bladder is the character of the secreted urine: its concentrated condition, its tendency to become ammoniacal from decomposition of excess of urea, or from the amount of salts, such as phosphates or uric acid, and hence the necessity for careful examination of the urine, when recently passed, as to its acidity or alkaline or neutral condition to guide us in prescribing. In most cases the irritation gives rise to increase of mucus from the coats of the bladder, and this tends to act as ferment, and urine which has been secreted of natural acid quality becomes ammoniacal in the bladder. In cases where there is either uric acid or phosphates in excess, the use of distilled water will be found of great service in allaying irritation by simply dissolving the salts, when we ascertain decidedly the nature of salts present. Then the exhibition of alkaline medicines, such as potash or lithia in the case of uric acid, or of dilute nitric acid in phosphatic urine, or dilute nitro-muriatic acid in the case of oxaluria, will still further assist in getting rid of the source of irritation. In some cases where patients suffer from irritable bladder in consequence of affections of the digestive organs, we sometimes find that the patient, after emptying the bladder, suffers intense pain and desire to pass water, which continues until, with great straining, he passes a quantity of mucus and white salts almost like pus in appearance, and then all irritation ceases for the time. In such cases it is well to wash out the bladder with weak carbolic wash—1 part to 120 parts of water—by means of such a catheter as we use for evacuating *débris* of stone after lithotomy, so as thoroughly to get rid of any salts present at the neck of the bladder. I believe that in many such cases the secretion of mucus and phosphates is principally from the irritable state of the prostate, for the urine first passed is often of strong acid reaction. When the urine is alkaline or neutral, besides washing out the bladder, benefit will be derived from injecting a very weak solution of nitric acid—one drop to the ounce—and leaving a little in the bladder. Besides these local measures, we must, of course, at-

tend to careful regimen as to diet, according to the conditions present in each case. I have known intense suffering arise in cases of phosphatic urine from the patient taking pease-meal or revalenta arabica to regulate their bowels, the excess of phosphates contained in such articles of food more than counterbalancing the medical treatment.

The presence of albumen, as indicating renal disease either organic or congestive, is a most important condition to be attended to, and should be met by sinapism or dry-cupping over the loins and the use of diluents. In the strumous prostate in young persons, the kidney sooner or later always becomes affected, and in the earlier stage, before the general health has suffered, the excessive vesical irritation closely simulates the symptoms of stone in the bladder.

INFLAMMATION OF THE BLADDER.—This disease occurs both in an acute and chronic form. Acute cystitis is not frequently met with. In some cases of retrocedent gonorrhoea the inflammation, which is most generally confined to the prostatic urethra, passes to the mucous membrane of the bladder, producing acute cystitis. There is intense pain in the hypogastric region, increased on pressure, pain extending up along the course of the ureters, constant desire to pass water when there is not more than an ounce in the bladder, and this is attended with agonising straining; occasionally the urine is tinged with blood. There is pain referred to the point of the penis. The condition is usually ushered in by slight rigor followed by pyrexia. The tongue is white and soon becomes furred and foul, and there is a peculiar feeling of nausea and loathing of food. The morbid condition is a very serious one, and requires to be met by prompt measures. Hot fomentations, or an india-rubber bag partially filled with warm water, should be applied to the hypogastric region, and an opiate enema administered. When, as is often the case, the patient is robust, you will find the application of leeches to the verge of the anus of great benefit, by relieving the prostatic and vesical plexus of veins, and then opiates and other remedies act more efficaciously. The warm bath or hip bath is often recommended; but as there is always a risk of chill in removing the patient from the bath, I prefer the vapour bath. The patient is placed between blankets, and then damp flannel cloths wrapped round, and heated bricks are placed between the blankets at some distance from the patient. This soon produces profuse perspiration, whilst at the same time the patient is encouraged to drink freely of diluents. The bowels require to be regulated by castor-oil, but not so much as to disturb him frequently. In the early stage I trust specially to distilled water as a diluent, and to the use of bromide of potassium with camphor mixture to allay the pain and irritation, to the exclusion of other medicinal preparations, except occasional opiate enemata or suppositories. Relief of nausea will be best effected by applying sinapisms over the epigastrium. Sinapisms may also be applied over the lumbar region to allay renal irritation.

It sometimes happens that, after frequent micturition has continued for a time, spasm and engorgement, arising from the straining and inflammatory congestion at the neck of the bladder, lead to

retention of urine, and the patient suffers great agony when even five or six ounces of urine are retained. In such cases the use of the catheter should, if possible, be avoided; a full opiate enema should be administered, and the patient placed in a hot bath. If these means fail, then the catheter must be passed; but before doing so the patient should be chloroformed, as the passing an instrument under such circumstances is very painful, and the congested mucous membrane of the urethra easily lacerable, and it very frequently happens that when the patient is brought thoroughly under chloroform, and ice-cold water applied to the semi-erect penis, he passes water in full stream, and so catheterism is avoided. If this does not occur, these means facilitate the gentle use of the catheter; and when the urine is drawn off, tepid water very slightly carbolised, or a weak solution of borax, should be injected to wash out the viscus. This condition will be found treated of under the head of spasmodic stricture.

Chronic inflammation of the bladder is generally dependent on organic stricture, disease of the prostate, and other affections of the urinary organs. Its symptoms are very much the same as those of irritable bladder, intensified, more persistent, and attended with increased secretion of mucus or muco-purulent matter, or pus mixed or streaked with blood, and after a time affection of the general system, and ultimately, if not checked, uræmia may supervene. In many cases of bad stricture the urine has almost the consistence and appearance of thin gruel, so that when a small catheter is passed to relieve retention the contents of the bladder cannot be voided through the instrument; and I have frequently been obliged, after passing a No. 2 catheter to withdraw it and perform perineal section to enable me to pass a full-sized catheter to evacuate the contents and then wash out the bladder, and both in stricture and prostatic disease, owing to a portion of the urine not being expelled, it becomes decomposed and ammoniacal, and keeps up, if it does not excite, the inflammatory state. Under these conditions the indications for treatment are washing out the bladder, and remedies to meet the state of the urinary secretion in each case as palliative, and then the special treatment for stricture or prostatic disease according to the nature of the case.

In approaching the consideration of **STONE IN THE BLADDER**, I need hardly seek to impress you with the importance of the subject, for there is no disease, either medical or surgical, the treatment of which has attracted so much general attention. All kinds of secret medicinal agents have from time to time been vaunted as solvents of the offensive body, and a British parliament, with a view to benefit the public, once voted a large sum to purchase the secret of one of these, the efficacy of which was strongly vouched for. The wonderful remedy turned out to be lime-water! Whatever use may result from medicines used internally in preventing the formation of stone, or correcting the conditions in the digestive functions which lead to its formation, or in allaying the symptoms, I fear that when a stone is formed we must trust to surgical procedure for its removal. Injection of fluid solvents into the bladder has been proposed and tried, but an acid or alkaline

solution sufficiently powerful to act energetically on the calculus would be still more likely to act detrimentally, if not destructively, on the coats of the bladder; indeed, even frequent injection of the bladder with simple tepid water is not very safe. A time may come when medical therapeutics may achieve a triumphant solution at once of this difficult problem and of the stone; meanwhile, it is to the surgeon that the patient afflicted with stone in the bladder must look for aid and permanent relief.

In considering this important disease and its treatment the surgeon must not limit himself to the mere local condition, and the methods of operating necessary for its cure. He must, equally with the physician, examine into the probable causes of the origin of the disease, both as a subject of pathological interest and as indicative, in many cases, of constitutional tendencies requiring his attention either before or after his operations, and in deciding him as to the plan of operation he may adopt. But this is not the proper place to enter on the chemical composition and tests for the different forms of urinary calculi; nor, except incidentally and in the briefest manner, can I enter on the physiological conditions which, under certain circumstances, may lead to the formation of stone.

The formation of urinary calculi is now generally admitted to depend on some derangement of the primary or secondary digestion—a portion of the products of digestion being deposited in the kidney or bladder in the form of urates, phosphates, or oxalates. The disease seems to be endemic in some localities, and is sometimes referred to the nature of the water drunk by the patients. In the neighbourhood of limestone, for example, there is a tendency to earthy deposits in the urine, either directly, or more usually owing to derangement of the digestion, leading secondarily to the formation of calcareous deposit. In Great Britain, calculous disease is very frequent in Norfolk and in the north and north-east of Scotland, while in other districts it is comparatively rare, though occasionally met with everywhere. In India it is exceedingly common, especially in the north-west upper provinces of Bengal. In the Madras Presidency it is not so frequent, and yet there the operation has been long practised by the natives. In those departments of this country in which it is most common, I think we shall find evidence of some common cause, leading to derangement of the digestive organs, as, for example, in the food not being very digestible; while in other parts of the country, where the diet is different, the disease is more rare.

There are four different forms of urinary calculi generally recognised, but we must keep in mind that a urinary calculus very generally consists of strata of different salts.

The *Lithic* or *Uric Acid* deposits are the most common either as gravel or stone. Uric acid calculi vary in colour from a reddish orange to a dark brown colour, are hard and consistent, sometimes rough on their surface, at other times quite smooth, and frequently of large size.

The *White Salts*—phosphates of lime, and the triple ammonio-magnesian phosphate—form calculi, white, very friable, and often of

large size. Oxalate of lime forms the "mulberry" calculus. Cystic oxide, which is an exceedingly rare calculus, is of a pale yellowish tinge, and rather firm consistence. There are certain points to be attended to as regards these different kinds of urinary calculi, with reference chiefly to the prognosis of the disease, and the probability of a favourable result after operation.

When the calculus consists of pure phosphate of lime, or of the triple phosphate, the prognosis is not, as a rule, very favourable. This form of stone occurs in old people, or in those whose general health and nervous system have been much shattered, and where there is a large elimination of the phosphates from the system. This generally indicates an unfavourable condition of the patient, but at the same time we must look to all the circumstances of the case. It is very common, for example, to find the main body of the stone composed of uric acid, while outside there is a layer of phosphates, deposited in consequence of the chronic inflammation of the bladder, and from the urine being at times phosphatic. But when the whole body of the stone is composed of phosphates the prognosis is unfavourable, because phosphaturia generally shows a great deterioration of the general health, and especially of the nervous system; and when this occurs in young persons the prognosis is still more unfavourable, for in them there is not the same natural tendency to the deposition of phosphates that there is in the old. In the young, when there is great irritability and much pain, with alkaline urine, the chances of a successful result after lithotomy are doubtful. Even after the operation, in some instances we find the margins of the wound coated by the white salts, showing the tendency to the deposition of phosphates from the urine. Phosphatic calculi may form originally in the prostate, and then they do not indicate any constitutional disturbance, but depend on the nature of the prostatic secretion, and consequently are not necessarily unfavourable cases for operation.

The oxalate of lime, or mulberry calculus, is excessively hard and dense, of a very dark brown colour, and presents a peculiar nodulated appearance. It derives its name from its form and colour. When present it gives rise to great pain in the bladder from two causes, first, from the rough irregular surface of the stone, and secondly, even when the sharp points are not present and the surface is quite smooth, from the sensitiveness of the nervous system present in oaluria. In some instances the mulberry calculus attains a large size, but most generally, owing to the intense pain it occasions, the patients apply for relief before it has become so large as other forms of stone.

In the uric acid calculus we find the stone composed of different strata. It is occasionally coated with phosphates and urate of ammonia. The phosphate of lime calculi are excessively brittle, even though the nucleus be composed of uric acid.

A calculus may attain a very large size, and may be of almost any form. A patient suffering intense pain from stone in the bladder may, under some remedy such as lime-water, be completely relieved for a time, and think he is cured of the stone; but the real state of matters is, that the patient was suffering from a uric acid or mulberry calculus

with rough surface, which was the cause of the intense pain at first. Owing to the irritation of the bladder, the tendency to the deposition of phosphates had perhaps already begun, and this would be increased by the action of the lime-water. The deposition of the phosphate of lime would round off the rough surface of the calculus, and make it smooth, and its presence comparatively or altogether painless. This shows that we cannot be sure of a stone having disappeared under the action of internal remedies, for the improvement in the symptoms is in general due to such causes, and only temporary.

The symptoms of stone are very analogous to those of an irritable bladder. There is pain in making water, with a frequent desire to micturate. The stream sometimes stops suddenly from spasm produced by the presence of the stone, or from the calculus falling over the orifice of the bladder, and after a pause begins to flow again, either spontaneously or when the patient alters his position. Occasionally the patient suffers intense pain while making water in the ordinary position, which passes off on changing his posture. The stone in the first instance has been resting on the most sensitive part of the bladder—viz. between the orifice of the ureters and the base of the prostate, and the relief is caused by the stone falling from off this sensitive part when the patient changes his posture, the water then passing more readily and with much less pain. There is pain *after* making water, generally intense suffering, if the stone be rough and irregular, owing to the bladder contracting on the stone. In most cases the patient strains very much in passing water, and a little mucus and blood are expelled with the last drops of urine. In young patients the prepuce is generally very much elongated. This arises from the peculiarity of the irritation produced by the stone—the pain is referred to the glans penis or orifice, and the patient grasps the glans, dragging the prepuce forwards while making water, so as to benumb the pain, and this causes the great elongation of the prepuce. In the adult, also, the glans penis is very often compressed and irritable, from the patient pressing on it to relieve the pain while making water.

These are the general symptoms of stone, but they may be simulated by those of some other diseases. In irritable bladder and chronic or acute cystitis many of the symptoms are identical with those of stone; there is a constant desire to pass water, with pain in doing so from the violent contraction of the muscular fibres and from the irritable state of the mucous membrane of the bladder; and sometimes, from the irritation and spasm, the stream of water is arrested for a little, and then goes on again. In disease of the prostate, also, there is a similar condition, but both in this and in irritable bladder, the pain, as a general rule, is greatest before and whilst making water, and relieved after the bladder is emptied; if there is any pain after making water it gradually passes off, whilst in stone the pain is, as already explained, most intense after the bladder is emptied.

It is not always easy to diagnose disease of the prostate from stone in the bladder. In cases of enlargement of the third lobe of the prostate, when that projection is incrustated with earthy matter, the irritation thus produced is almost identical with that caused by a calculus,

as the lobe is somewhat pendulous, and in some cases forms a valvular projection; there are, in fact, physical causes in operation similar to those which give rise to the symptoms in cases of stone in the bladder. Even in sounding there is a difficulty in diagnosis, for we feel the sound rubbing against the earthy matter on the prostate, which communicates a sensation like that produced by the rub of the sound on a calculus, and in the case of the pendulous projection we can pass the sound above and under it. In children the presence of ascarides in the rectum may very closely simulate the symptoms of stone. I have in several cases seen all the symptoms of stone present when no stone really existed, and they disappeared when the ascarides were removed from the rectum—hence, in any doubtful case, we should, especially in children, examine the state of the lower bowel.

The pair is not always in proportion to the irregularities on the surface of the stone, for we have sometimes a smooth surface accompanied by symptoms as severe as those produced by mulberry calculus. This is due more to the deranged nervous condition which gives rise to the disease than to the actual degree of local irritation.

The symptoms in diseases of the kidney, especially in some cases of albuminuria, when this is combined with scrofulous disease of the prostate in boys, are exceedingly like calculus. All the symptoms of stone may be present, and depend entirely on the above causes; the general health, however, in these cases very soon gives way. The only sure diagnostic for stone in the bladder is the use of the sound, and the method of doing this will be fully considered by and by.

In all urinary affections we ought to be very particular in examining into the general symptoms of the patient, the state of the pulse and digestive organs, and especially the condition of the urine. When there is any reason to suspect a tendency to the deposition of phosphates, or that the urine is albuminous, the urine should be examined repeatedly. When a little of the urine is heated, if there be any phosphates in it, it becomes opaque and muddy; but on adding a drop or two of nitric acid it at once becomes clear again, with perhaps some slight effervescence. The phosphates are decomposed by the acid and dissolved. If albumen be present, the addition of nitric acid will only make the urine more opaque than it was after being heated. When pus is present the tests of heat and nitric acid give results somewhat similar to those of albumen; but if, instead of nitric acid, we add a few drops of liquor potassæ to the opaque urine, the pus becomes tenacious and viscid. When both albumen and phosphates are present in the urine, and if this condition be persistent, the case is a very unfavourable one; still, in many of these cases we must allow for a certain amount of fibrinous matter, the result of irritation of the organs, causing the albuminous deposit, and then the average specific gravity of the urine must be carefully ascertained. When the phosphates are very largely present, and when the general state of the patient indicates debility or nervous exhaustion, though that should not absolutely prevent us from operating, still the prognosis is unfavourable, especially when the patient is young. In phosphate of lime calculi the condition

is generally due to prostatic calculi, and the prognosis is not necessarily so unfavourable. The oxalate of lime or mulberry calculus is not unfavourable for operation, but after its removal the use of nitro-muriatic acid and other tonics is required. Cases of uric acid calculi are generally favourable as regards the prognosis, and in them there is seldom anything to contra-indicate the operation after the presence of the stone has been ascertained.

LECTURE CVII.

Operations for the Removal of Vesical Calculi—Lithotritry, Litholapaxy, and Lithotomy : the Cases most suitable for these Operations—Preliminary Exploration of the Bladder, or Sounding—Lithotritry.

UNTIL recently there were only two great methods of getting rid of stone in the bladder—*Lithotomy* and *Lithotritry*, each method being more suitable for certain cases than for others. More recently the modification of Lithotritry termed Litholapaxy, or complete evacuation of the crushed stone at one operation, seems likely to supersede ordinary lithotritry, and even to invade the domain of lithotomy to some extent, as dealing with larger calculi than lithotritry. When lithotritry can be performed in cases where everything is favourable for it, there is no doubt that the operation is one attended with less risk to life than lithotomy ; but then, unfortunately, it happens that the cases suitable for lithotritry are comparatively rare. In private practice, among the better class of patients, lithotritry can be performed much more frequently than in hospital practice ; for in the former the patient generally applies to a surgeon early, whilst the stone is still small and friable, and before its presence has excited any great amount of chronic vesical irritation, and when therefore it can be crushed under the most favourable circumstances. But there are certain conditions which must be attended to in deciding which is the preferable operation in each individual case. What, then, are the conditions favourable for the performance of lithotritry ? The stone must be of a small size, or at all events not large ; it must also be of a somewhat friable composition, and likely to yield readily to the crushing instrument introduced into the bladder *per urethram*, because the force we can employ is limited by the size of the canal. The stone should be friable in a particular way. It should break up readily into small fragments or sand. The oxalate of lime calculus is not friable in this way ; it breaks up into a number of small sharp fragments, which are not easily broken up completely, and these sometimes get impacted in the urethra, and cause a great deal of trouble and danger ; hence mulberry calculi are not cases in which lithotritry should, as a general rule, be employed. The kinds of stone best suited for this operation are the uric acid in its early formation, and the phosphatic calculi. These latter calculi are very readily broken up and crushed to powder, and after the earlier sittings, by injecting the bladder, portions of the stone may be dissolved and brought away, so that in many respects the phosphatic and soft uric acid calculi are the

most favourable, and the oxalate of lime the most unfavourable for the operation of lithotrity. Where two or more calculi exist, lithotrity is not so advantageous, as the different calculi are caught and partially crushed at the different operations, and hence there is a want of certainty as to the result.

The condition of the urinary organs should be attended to in choosing either operation. For lithotrity the bladder must be sufficiently capacious to retain a moderate amount of fluid, say from five to eight ounces. When the patient has suffered from stone for a long time, or when he is constantly making water, the muscular coats of the bladder get thickened and irritable, and the capacity of the cavity is diminished, so that it is unable to contain even a moderate quantity of water. The opponents of lithotrity used to argue that the operation could very seldom be performed on this account. We can, however, obviate this difficulty by injecting a little tepid carbolised water occasionally into the bladder, and so gradually increasing its capacity, and accustoming it to contain some bland unirritating fluid. If we can by such treatment get the bladder to contain say from five to eight ounces of water, we are quite justified in performing lithotrity, provided all the other conditions are suited for it.

The most important point, however, is the size of the canal of the urethra. It must be of such a size as to allow a full-sized lithotrite to enter the bladder. We must have an instrument of full crushing power, and therefore the urethra must be tolerably large to allow of the passage of the instrument. It must also be large for another reason—to allow the fragments of the stone to come away readily. If the urethra be small they will probably become impacted in the canal, and give rise to much trouble or even danger. It is obvious therefore that lithotrity is not an operation suitable for boys, for in them the urethra is neither large enough to allow of the passage of a full-sized instrument, nor to allow the larger broken fragments to come away readily with the urine; besides, in children, the bladder is generally very irritable in cases of stone. In children, moreover, the lateral operation of lithotomy when properly performed is almost unattended with danger, while the irritation caused by the use of the lithotrite is very great. I consider that lithotrity ought therefore never to be performed in children. When the prostate is enlarged and dense, as in old people, lithotomy is not so favourable, for in such cases we require to cut very freely and split up the resistant gland; and though there is little risk of infiltration of urine, and the operation itself is easy enough, and though the patient goes on very well for some time, even for weeks after the operation, yet we sometimes find that at a later period gastric and hepatic irritation set in, dysentery comes on, and the patient ultimately sinks. The wound itself may have healed, but it is the effect of the operation that has killed the patient; and therefore in this class of cases I prefer lithotrity if the stone be small and easily broken, and if the prostate be not of such a form as to present a valvular obstruction to the passage of the fragments of the stone. In these cases we can introduce a full-sized instrument, and by proper medical treatment get over the irritable state of the bladder, and thus

there is every chance of a successful result after lithotritry, more especially as the calculi are generally phosphatic.

In the female we do not often require to operate for stone, because, from the shortness and straight course of the female urethra, calculi readily pass out of the bladder by the urethra if they are of a moderate size, and hence they do not often attain any great size in the female; but, when they do, they give rise to intense suffering and require some operation for their removal. If we perform lithotomy in these cases, or instead of this use mechanical dilatation, such as the sponge or tangle tent, or special dilating instruments, we can extract the stone readily enough by forceps; but then the patient is sometimes left in a very pitiable condition from the permanent incontinence of urine which results from the cutting or dilatation. Lithotritry has everything to recommend it in the case of females; in them the urethra is wide, short, and straight, and we can therefore introduce an instrument of great crushing power into the bladder, easily seize and act upon the stone, and there is a short, direct, and free outlet for the crushed fragments of stone. For these reasons, I hold that in females lithotritry is far preferable to extreme dilatation or lithotomy when the stone is so large as to require any such surgical interference.

In the adult male, however, when the stone is tolerably large and the patient is otherwise healthy, with no great enlargement or hardness of the prostate, and when several sittings would be required before the stone could be thoroughly crushed by lithotritry, I think that lithotomy is generally the preferable operation. There is no great danger attendant on lithotomy if it be properly performed; and I would therefore limit lithotritry in the healthy adult male to those cases in which the stone is small and easily friable, and the bladder not excessively irritable, and to cases of enlarged and rigid prostate.

Before proceeding to demonstrate the method of performing lithotritry or lithotomy, I must first describe the preparatory exploration of the bladder with the sound, which, as I formerly stated, is the only positive diagnostic of the presence of a stone. This preliminary operation, though simple, requires certain precautions, and must be proceeded with methodically, so as to make sure of detecting a stone if present; and also to ascertain, approximately at least, the bulk and general character of the calculus. Whilst sounding the size of the prostate and its consistence should be examined, so that we may if possible avoid any unnecessary explorations prior to the operation. Before proceeding to sound the patient the bowels should be cleared out, and the rectum emptied by an enema. If the bladder be not very irritable, the patient should be made to retain his urine for an hour or so before the examination. If, however, the patient be unable to retain his water, then we must inject some tepid carbolic water into the bladder. This requires to be done very gently, by means of a slow continuous stream, avoiding all jerking, pausing occasionally to give time for the muscular coat to dilate gradually. About six or seven ounces of water are quite sufficient to enable us to explore the bladder fully.

The form of sound to be used is of some importance, for with a

sound with the curve of the ordinary catheter we cannot move the instrument freely in the bladder, and might readily pass over a flat stone lying in the pouch behind the prostate—a position the stone often occupies—and this will be more likely to occur in old persons, or in patients in whom the gland is enlarged. For these reasons the sound is generally made with a short and rather sudden curve, so as to enable us to turn the point in all directions, and sweep the whole cavity of the bladder. Of late years I have generally used a sound with the end made of the same oval form as the closed lithotrite, but the stalk much smaller—about No. 7 or 8 gauge—to enable it to lie loose and move easily in the urethra. I first used this to prepare the urethra for the lithotrite; but I found it so easily moved in the bladder and gave rise to so much less pain than the ordinary sound, that I now use it in almost all cases in the adult.

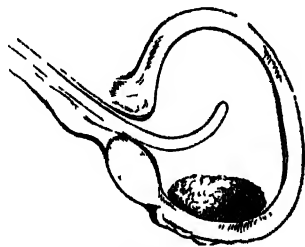


Fig. 213.

In most cases the closed scoop lithotrite answers very well to sound with, and has moreover this advantage, that it enables the surgeon to measure the bulk of the stone by seizing it between the blades. In all cases, however, we should have at hand sounds of different curves, and a short pointed catheter. This last-mentioned instrument is sometimes needed, not only to enable us to inject water into the bladder, but also in cases where the detection of the stone is difficult. By using the catheter and allowing the urine to escape slowly, it often happens that as the bladder contracts the stone is brought into contact with the instrument, which can then be used as a sound. Whilst I consider the short pointed sound as most suitable for complete exploration, I cannot help noticing a circumstance which has often struck me—viz. that in cases even where there had been some difficulty at first in detecting the stone by the sound, I never knew an instance in which the staff, when introduced for the purpose of performing lithotomy, did not almost at once strike the stone, though, from its long point and larger curve, it seems the most unlikely form of instrument for the purpose.

In proceeding to explore with the sound, the preparations already mentioned having been attended to, the patient should be placed recumbent, with a pillow placed under the hips to elevate the pelvis. The surgeon, standing on the left side of the patient, introduces the sound, previously warmed and oiled, into the urethra. If the oval-pointed sound or the lithotrite be used for exploration, the large extremity must be introduced so as to present its flattened surfaces to the sides of the orifice, to suit its long axis—not transversely, which would over-distend the opening. The instrument is then carried onwards, with the extremity bearing gently towards the right side and upper surface of the urethra, until it reaches the opening in the triangular ligament; the penis is then drawn gently forwards on the sound,

Fig. 213. Sounding. The stone in its ordinary position.

whilst at the same time the operator depresses the handle of the instrument, to make it take the turn of the canal, and pushes it onwards till he feels it enter the bladder.

In depressing and passing home the sound no force should be used; merely the gentle pressure of one or two fingers on the upper surface of the handle will suffice; and when the lithotrite is used, the weight of the handle of the instrument requires only the finger to guide and give it direction.

When the sound has entered the bladder it may possibly strike the stone at once; but still we require to ascertain its bulk, and whether it is movable, and other conditions. The surgeon waits for a minute or two, and then proceeds to move the sound with great care and lightness over the interior of the bladder. If the patient has been placed as directed, the instrument naturally glides down the inclined plane from the prostatic part of the urethra, over the trigone, towards the posterior fundus of the bladder, and, as the stone has most likely fallen back in that direction, it may strike it at once. If it does not, the curved extremity should, by merely rotating the handle, be moved first to one side and then to the other. If this manœuvre does not succeed in detecting the calculus, then the sound is made to sweep round the whole surface, and, as it is withdrawn to near the neck of the bladder, the concavity of its curve is turned backwards, so that the point may search the sac-like part of the "bas fond" of the bladder, which exists when there is an enlargement of the prostate. If not felt there, the concavity is turned forwards, in case the stone be resting on the pubis, a position it sometimes occupies, although this is not likely to be the case when the patient is recumbent.

Should nothing be felt, the patient is then brought into the erect position, and the catheter may be used to empty the bladder gradually, when the stone, if there be one, will probably be brought in contact with the instrument. It is advisable, however, to avoid introducing many different instruments; and, if the form of sound I have described, or the scoop lithotrite be used, if the handle be a little depressed, so that the large extremity is removed from the neck of the bladder, the patient in most cases can pass water by the side of the instrument, and there is therefore no use in introducing the catheter, and irritation is thus avoided. When the calculus is touched, the surgeon passes the end of the sound over its surface, so as to gain some idea of its length and breadth; next, he passes the point by the side of the stone to measure its thickness; and then, passing the sound under it, he determines its mobility, and at the same time gains some notion of its weight. The knowledge so gained, however, is very imperfect, as you may easily conceive. If, however, the lithotrite be used as a sound, then, when the foreign body is felt, the surgeon, by opening the blades widely, and gradually closing them, will generally get the calculus between the blades, and will thus be able to form a pretty accurate idea of its bulk. Of course he must examine it in different positions, for a small stone caught in its longest axis would give an erroneous idea of its bulk. The grasp of the lithotrite also serves to indicate, in some degree, its character of hardness or softness.

In cases where, after careful exploration, gently carried out as just described, we cannot detect a stone, we should desist, use means to allay the irritation of the bladder, and after a few days examine again, using an instrument of a different form, should that be thought advisable.

In sounding, care must be taken to avoid being deceived as to the sound touching a stone. I have known the surgeon and those present momentarily deceived by the sound produced by the handle of the instrument striking a ring on the operator's finger; and not unfrequently, in disease of the third lobe of the prostate, the projecting part is covered with earthy sabulous matter, and the same earthy deposit may take place on the projecting rugæ, caused by the hypertrophied muscular coat of the bladder. We must never be satisfied by feeling a mere rub, but should make quite sure of the presence and mobility of the concretion felt.

Having thus described the process of exploring the bladder to ascertain the presence of a stone, I now proceed to describe the different operations for the purpose of crushing or extracting it, and begin with LITHOTRITY.

In describing the method of performing lithotritry, I have no intention of describing or discussing the merits or the mechanism of the different forms of lithotrites now used; for that information I would refer you to the works of Sir William Fergusson, who has done so much to simplify and improve the instrument, and to the monograph of Sir Henry Thomson. The instrument which I show you is that usually known as Sir Henry Thomson's Lithotrite, and for ordinary practice you require two of these—one powerful, and having the end of the female blade fenestrated; the other, the scoop lithotrite, in which the flattened end is hollowed to receive the end of the male blade, but not fenestrated. The former of these instruments is intended for crushing the stone in the first operation, and is fenestrated to permit the larger fragments to be thrown out from between the blades. It should be very powerful, and cut from the solid metal. The other is used in the after sittings, to reduce the fragments to sand, and hence no opening is made in the end of the female blade. Both instruments act on the same principle, and have two movements. As I use it now, you will observe it acts with a sliding movement, so that I can readily open and close the blades, and use a certain amount of percussion by pressing on the handle of the lithotrite with the ball of my thumb; but when, with the point of my thumb I draw up the small button-slide towards the handle, I at once convert the movement into the powerful screw action; and this again can be altered by pushing down the slide. This form of lithotrite the surgeon can use with great facility.

The preliminary arrangements for, and the earlier steps in the operation of lithotritry, are so similar to, or identical with those of sounding just described, that I shall only briefly recapitulate them here.

The patient should have the lower part of the bowels cleared by an enema about an hour and a half before the operation, and should be

told to retain his urine. Should his bladder be too irritable to retain a sufficient quantity of urine, the surgeon must in that case inject six or seven ounces of tepid carbolised water into the bladder, using the precautions I mentioned when speaking of sounding. The patient should be placed on a firm table, lying on his back, his head moderately raised, and a thick or doubled pillow placed under his hips, to elevate the pelvis, and favour the calculus falling backwards. In using the sound or lithotrite, I prefer to stand on the left side of the patient, and then, having warmed and thoroughly oiled the fenestrated lithotrite, I introduce the broad flattened beak of the instrument sidewise, so as to correspond to the long axis of the urethral orifice. I then glide it downwards, bearing gently towards the right side and upper surface of the canal, and gradually bringing it away from the abdomen. On reaching near the sinus of the bulb I draw forwards the penis gently on the instrument, and depress the handle, to make it take the turn and enter the membranous and prostatic portions of the urethra. Then, keeping the instrument in this position, with the pressure of a single finger on the extremity of the handle, it is gently pushed along

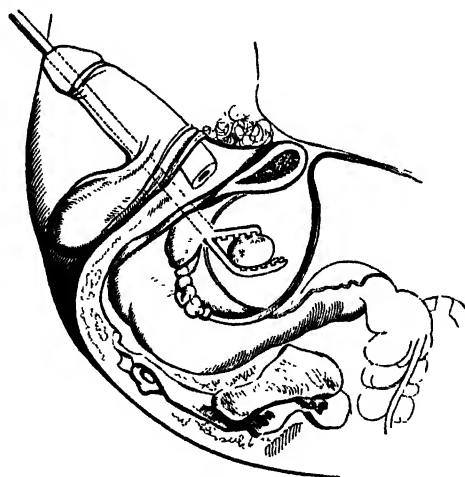


Fig. 214.

the prostatic urethra, and enters the bladder. In passing the lithotrite no force is permissible or necessary. When the lithotrite has entered the bladder the surgeon pauses for a moment, and then begins to search for the stone. In the position in which the patient has been placed, it is probable that, as the instrument glides backwards, it will strike the stone at once. If it does not, the closed lithotrite is gently withdrawn towards the neck of the bladder, and then, by turning the handle, the beak of the instrument is made to turn first to the right and then to the left side, to feel if the calculus be there; or its point is turned backwards behind the prostate in case the stone be lying

Fig. 214. Plan of Lithotripsy. The stone caught, and the instrument in a suitable position for crushing.

close behind the gland. If not found in any of these positions, the patient should be slightly moved to try to change its position, and the lithotrite swept gently round the bladder. Some recommend that the blades of the lithotrite should be opened pretty widely and depressed, and then closed, to try to catch the stone. I have occasionally succeeded in doing this when I could not detect the calculus with the closed lithotrite, but it seems to me an uncertain proceeding, and one not to be generally recommended. Other operators recommend gently pressing the end of the lithotrite back towards the posterior fundus of the bladder, so as to make a depression, and then opening the blades to allow the calculus to fall into it, and this is the method most generally successful. Various other methods have been proposed, and that of Civiale is a very good one. Having felt the stone with the lithotrite, he turns the beak towards the opposite side of the bladder, and opens the blades widely, then turning them over to the side where the stone lay, he gradually closes them on it. The stone being caught and carefully secured between the blades of the lithotrite, the operator now gently depresses the handle, so as to raise the instrument and stone from the posterior fundus of the bladder, and bring them into the centre of its cavity, away from its walls.

He grasps firmly the handle of the lithotrite with his left hand, glides the button of the catch upwards by a touch of the thumb of his right hand, and so converts the sliding into the screw action. With a gentle turn of the screw he fixes the stone firmly, and then, by half-turns of the screw, he exercises at first a sort of percussion force on the stone, till he feels it begin to yield, and, by the more forcible screw movement, he gradually crushes the calculus. When the fragments are felt to separate and fall out of the lithotrite, the surgeon should screw the blades fairly home.

By pushing down the catch the operator resumes the sliding action of the instrument, turns its beak, laterally depresses it, and separates the blades, so as to enclose any large fragment, which he crushes either by simple pressure of the blades or by reverting to the screw if necessary. This may be repeated on one or two fragments, but great caution is required, to avoid the temptation to do too much at the first sitting.

After the operation the patient should lie on his back, and an opiate suppository should be administered, or bromide of potassium in camphor water may be given, to obviate irritation and prevent the patient straining to make water. He should be encouraged to drink freely of diluents, such as thin barley water. In passing water he must not be allowed to stand up or kneel, as by so doing sharp fragments may be forced into and become impacted in the urethra, lacerating it, and giving rise to great danger. He should pass his urine lying on the back or side, and the urine should be kept in a glass vessel to permit the detritus to subside. Very little of the *débris* of the calculus passes during the first twenty-four hours; but, if the patient drinks freely of diluents, the fragments become water-worn and rounded, and then pass more readily when the patient makes water. No second examination or operation should be had recourse to for at least four or

five days. More generally, a week should elapse, and then we should only interfere if all irritation from the first operation has ceased. On the occasion of the second sitting, as it is termed, we should use the scoop instead of the fenestrated lithotrite, our object now being to crush any broken fragments into sand.

In the first and second operations it is not desirable to wash out fragments by injecting the bladder; but afterwards, when we feel sure that only some moderately small fragments remain, we may proceed to wash out the bladder by means of Clover's apparatus, which consists of a large catheter, with the eye, in the concavity near its point, fitted to an india-rubber bottle, with an intermediate glass reservoir, into which the detritus falls.

The forcible injection of a sharp fragment of stone after the first crushing is a serious danger, and various forms of forceps have been proposed for extracting such fragments. If it has been forced very near the external orifice there can be no great difficulty in getting it out by gently pressing it forwards to the orifice, which may, if necessary, be dilated or cut. When the fragment is placed far back, attempts to use forceps would, in my opinion, only add to the mischief. The safest plan, in such cases, is to push it back into the bladder by gentle pressure, with a full-sized catheter, or by a stream of tepid water injected into the urethra. Should the fragment be large and firmly impacted near the sinus of the bulb, I consider that an incision in the middle line of the perineum would be safer practice than attempting its removal by urethral forceps, however ingeniously devised for the purpose. In extreme cases, where one or more fragments have become impacted in the prostatic or membranous portions of the urethra, the mesial or lateral operation of lithotomy should be performed. Such cases, however, must be of very rare occurrence, if ordinary precautions are observed.

With the view of shortening the duration of the treatment, and preventing the irritation and risks consequent on the presence of the fragments of crushed stone, Sir William Ferguson uses small scoops, of different sizes, to remove them from the bladder.—*Lectures on the Progress of Anatomy and Surgery*, page 100.

LITHOLAPAXY.—The method of performing lithotripsy was carried out on the principles described until 1878. In that year Professor Bigelow of Harvard University, introduced his method of "Rapid Lithotripsy with Evacuation," to which he has given the name of *Litholapaxy* (λίθος; λάπαξις—evacuation).

By his method calculi are crushed, and the fragments and debris removed at the same sitting.

He was led to the development of this operation by the emphatic statements made by Otis regarding the large calibre of the urethra, and the ease and safety with which extremely large catheters could be passed.

Dr. Bigelow believes that although much disturbance is produced by a prolonged sitting to crush a large and hard stone, still less mischief will arise to the bladder thereby, provided all the fragments are

removed, than by devoting three or four shorter but separate sittings to the work, since the presence of fragments in the bladder for a few days injures it more than the single prolonged examination. At the same time, by the immediate evacuation of all fragments, the laceration of the urethral canal by sharp pieces of stone in their passage through it is avoided, while no nuclei are left behind in the bladder to promote further calculus formation.

At the meeting of the British Medical Association at Cambridge in 1880, Sir Henry Thomson delivered an address on the subject of Litholapaxy, and in the discussion that followed, Sir James Paget, Mr. Cadge of Norwich, and several other eminent surgeons, took part.

Sir H. Thomson stated that the new method "renders lithotrity safer than before for stones already generally assigned to that process, and extends the crushing operation to some which are larger than those hitherto operated on." It also removes phosphatic deposits, not unfrequently left after lithotrity, which are "due to the injury done to the mucous membrane by sharp fragments of stone, and by continued instrumentation."

Mr. Cadge believes that the recurrence of stone by nuclei or fragments left in the bladder, a serious and by no means uncommon defect in lithotrity, will by the new method be prevented.

The operation has been extremely successful in Dr. Bigelow's hands, and has been frequently performed with admirable results by many surgeons in this and other countries. It may be well, therefore, to enter somewhat into detail regarding it.

The instruments necessary for its performance are—

1. Lithotrite.
2. Large Evacuating Catheter.
3. An Aspirating Syphon.

As regards the lithotrite, the ordinary one can be employed, but Bigelow recommends one of his own device, in which the blades are stronger, and moved by a weighted ball-handle, instead of the ordinary wheel. The lock is so arranged that it can be closed by rotation of the right wrist without displacement of the fingers of either hand. The shape of the blades is a special feature in Bigelow's instrument, and is calculated to



Fig. 215.

admit of the easy escape of any detritus from between them, and thus injury to the neck of the bladder, which is so apt to be caused by the withdrawal of the lithotrite in a loaded condition, is avoided. The female blade is longer and wider in the "shoe," and is non-fenestrated, having only a small "slot" in the heel, while the male one is provided with alternate triangular notches.

Fig. 215. Bigelow's Lithotrite.

REGIONAL SURGERY.



Fig. 216.

The *Catheter* should be, as nearly as possible, straight, and of large but uniform calibre. Bigelow commonly uses a No. 14 or 16, but even higher numbers than these may be employed. Near its extremity



Fig. 217.

is a large oval orifice. Some surgeons prefer the end of the instrument to be slightly curved.

Of the *Aspirating Syphon* there are various forms. The ordinary

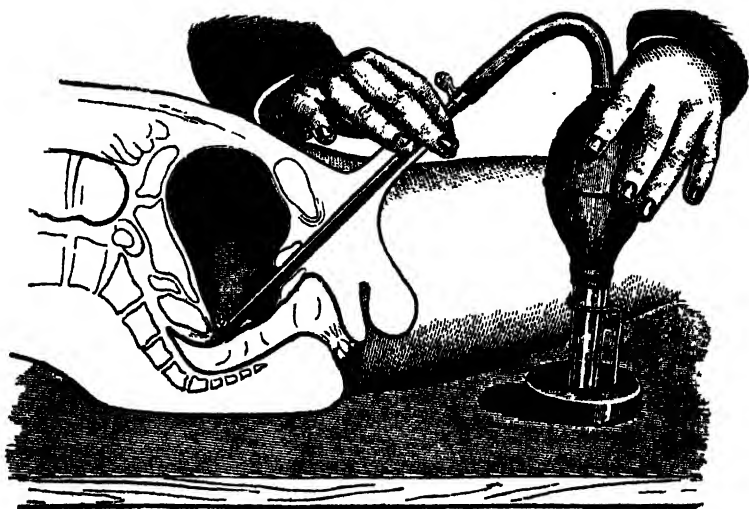


Fig. 218.

one has two globular chambers communicating with each other, the upper one made of india-rubber, the lower one of glass. The upper ball is fitted with two tubes with stopcocks; by one of these the whole

Figs. 216, 217, 218. Instruments and method employed to evacuate the bladder.

apparatus is filled with water, and by the other it can be connected with the evacuating catheter. The instrument is mounted on an appropriate stand.

As regards the operation itself. The patient having been etherised, a few ounces of water are injected into the bladder, and the lithotrite passed and the stone broken up as much as possible. The lithotrite is then withdrawn, and the large catheter introduced. A tape or elastic band tied round the penis near the scrotum retards the escape of water, while it allows of the movements and passage of either instrument. The aspirating syphon (previously filled with water, and air excluded by turning the stopcocks) is applied to the catheter by the tube already described, and the stopcock upon it opened, when the surgeon compresses the india-rubber globe with his right hand, while with the left he adjusts and alters the position of the catheter from time to time. By the subsequent expansion of this bulb, many fragments of the stone are sucked up through the catheter into it, and then gravitate into the lower glass chamber.

After about twelve evacuations, remove the catheter, reintroduce the lithotrite, and crush any fragments left. Repeat then the aspiration, and subsequently, if necessary, the whole process several times.

Should the catheter become obstructed, a rod may be passed down through it into the bladder.

It will be seen that in this operation the stone, although crushed, does not require to be pulverised. In order completely to empty the bladder of all *débris*, the catheter should be made to indent the floor, and this especially in the later evacuations.

The sitting may be prolonged for an hour or even longer.

Litholapaxy, therefore, invades somewhat the province of operation hitherto claimed solely by Lithotomy, and its more enthusiastic advocates predict for it a brilliant future.

But while admitting that in it an advance has been made in the surgery of calculus, and that possibly by its performance in a few cases the more serious operation of lithotomy may be avoided, still there remains a large proportion of cases in which, for many reasons, lithotomy is the only suitable and proper operation to perform.

LECTURE CVIII.

LITHOTOMY—Supra-pubic, or High Operation—its Dangers, and Proposals for diminishing them—Steps of the Operation—After Treatment—Sub-pubic or Perineal Lithotomy—Different Methods—Anatomy of the Male Perineum with reference to Lithotomy.

I SHALL now describe to you as succinctly as I can the principal methods of performing LITHOTOMY, or the operation of cutting for stone.

The methods of performing the operation of lithotomy may be classified under two great divisions—**SUPRA PUBIC** and **PERINEAL LITHOTOMY**. The former, or High Operation, is rarely now performed except as an operation of necessity. In cases where there is any deformity in the bones of the outlet of the pelvis, or where the stone is excessively large, so that it cannot be extracted through the lower outlet of the pelvis, the high or supra-pubic operation is the only means of relieving the patient. It has, however, been proposed, even in such cases, rather to cut into the bladder by the lateral operation, and introduce a powerful crushing instrument, so as to break up the stone in the bladder when it is so large that it cannot be extracted in the usual way.

The supra-pubic operation has this great disadvantage, that, whenever the bladder is opened, it empties and subsides behind the pubis, and the urine tends to infiltrate into the loose sub-peritoneal cellular tissue of the pelvis. To obviate this a variety of methods have been proposed. Some recommend an additional incision to be made in the perineum into the membranous portion of the urethra, and a tube or catheter introduced into the bladder, to give a free dependent opening for the urine to escape, and so prevent or at least diminish, the risk of urinary infiltration. Others recommend cutting down on the bladder and exposing it; then, some forty-eight hours afterwards, opening it and extracting the stone. But, to say nothing of two operations, the objection to this latter plan is obvious—the patient could not contain his water for forty-eight hours; and therefore the bladder would shift its position by contracting, in the interval between the two operations. When the supra-pubic operation is really required, I believe that the best plan is simply to cut into the bladder above the pubes, with the proper precautions, and extract the stone; and afterwards to introduce, by the urethra, a flexible or vulcanised india rubber catheter, and keep

it constantly in, to allow the urine to flow off by the natural passage, and so prevent, or at least lessen, the risk of infiltration. Still further, by placing the patient on his side, and introducing a long narrow strip of gutta-percha tissue, previously varnished, into the wound of the bladder, and allowing the end to hang out over the side of the incision, the overflow of urine will pass along it. This may be still further assisted by means of tepid water constantly dripping into the wound from an irrigating apparatus, should that be thought necessary; but I confess I have but little faith in such irrigation. Or the operation may be performed under antiseptic precautions and the wound of the bladder closed after the stone has been extracted, but the wound in parietes left open and dressed antiseptically, the soft catheter kept in to serve as a drain. I have seen one case of the High Operation under treatment on the Continent, where the patient, a boy, was lying with the lower part of his body immersed in a tepid bath, and had been kept in it for some days. He seemed to be very comfortable. In some cases the incision of the bladder has been closed by a continuous suture of carbolised catgut; and if this be combined with a perineal section and tube, or the catheter left in the bladder, it is deserving of further trial.

I have only once performed the High Operation in my own practice, but in cases in which the prostate is greatly enlarged and rigid, I cannot help thinking that by adopting the supra-pubic method we would avoid the dangers incident to section of the prostate when so altered, whilst, owing to the bladder being permanently raised out of the pelvis in such cases, the risks of its subsiding after being opened, and consequently that of infiltration, would be lessened.

The principle of the operation is founded on the varying position of the bladder, and its relation to the peritoneum in different states of the viscus. When distended, the bladder rises above the pubis, and gradually throws upwards the fold of the peritoneum, which, in its contracted state, lies upon it. As it becomes very fully distended, the peritoneum is thrown off its anterior surface altogether, so that, by cutting down upon it in the mesial line above the pubis, we can open into the bladder without wounding the peritoneum. The bladder, therefore, requires to be very fully distended, or injected with water, before operating, so that it may occupy the proper position. Some recommend that a large catheter should be passed along the urethra, and the bladder projected before it, so as to form a guide to its position; but this is never a safe method.

The bladder having been felt distended above the pubis, the HIGH OPERATION is performed as follows. The surgeon makes an incision about two and a half or three inches long in the mesial line of the abdomen at its lowest part, immediately above and partly over the pubis. This first incision divides the skin and fat, and exposes the lowest part of the linea alba, which is next divided between the pyramidal muscles. The edges of these muscles and of the wound should be gently held, not dragged, aside by copper spatulæ. The knife should now be very sparingly used, if at all. With his finger the operator

separates the loose connective tissue, and passes his finger along the posterior surface of the symphysis pubis, recognises the anterior surface of the bladder, and, if possible, ascertains the position of the reflected peritoneum. He then feels for the distended bladder, and pushes his knife into it about an inch and a half above the pubis, with the edge directed downwards, and cuts towards the pubis, then hooking his finger in the opening so made, he draws forward the bladder, and, guarding the peritoneum, enlarges the opening. There is no necessity, however, for making a very long cut through the coats of the bladder, for the divided muscular coat readily yields, so as to allow the easy extraction of a very large calculus. The introduction of forceps and the extraction of the stone are not attended with any of the difficulties which are occasionally met with in perineal lithotomy.

The operation is unattended by any risk of hæmorrhage, and, as regards its manual procedure, is very simple; but unless the precautions I have described be attended to, the sac of the peritoneum may be opened and the intestines escape; and when I mention that this accident has actually happened, you will see the necessity for care. The error arises from making the incision too high above the pubis. The after-treatment is to be conducted on the principles already laid down when speaking of the dangers of this method, and the means of diminishing or obviating them.

All the methods of performing SUB-PUBIC or PERINEAL LITHOTOMY have for their object the extraction of the stone, by incisions, through the parts closing the inferior outlet of the pelvis. This outlet or space in which the incisions must be made is limited by osseous and ligamentous boundaries, and by the relations of the great pudic artery, and some of its branches, which, at certain points, lie close to the lines of incision of some of the methods. Deeply, towards the pelvis, the extent and direction of the incisions of the prostate are limited by the connections of the pelvic fascia; whilst posteriorly the widest part of the outlet is largely occupied by the lower part of the rectum.

As regards perineal lithotomy, the problem to be solved is to obtain an opening from the perineum into the bladder of sufficient size to admit of the easy extraction of the stone, without passing beyond the limits of the prostate gland and its fascial coverings, with the least risk to the pudic artery or its branches, and without injury of the rectum. In the recto-vesical method the last consideration is of course disregarded, as wound of the rectum forms in it a part of the operative procedure.

Lithotomy by any of the perineal methods is an operation which, although in many cases simple and easy of performance, is in other instances attended with great difficulties, requiring all the skill, dexterity, and determination of the most experienced to overcome. Such difficult cases the surgeon who undertakes the operation must be prepared to meet, and, like every other surgical operation, it especially requires a thorough knowledge of the anatomy of the parts concerned.

Although the modifications of the different methods of perineal lithotomy are almost endless, they may be enumerated under four

heads—viz. 1st, the lateral operation—that most generally performed; 2d, the bi-lateral operation; 3d, the central or median operation; and 4th, the recto-vesical or median operation, combined with division of the anterior wall of the rectum.

Before you can understand the comparative merits or demerits of these different methods, it is first necessary that I point out to you the general dangers of lithotomy. Amongst these dangers there are some common to all methods, such as phlebotic pyæmia, inflammation of the neck of the bladder, uræmia from suppression of urine, and the shock. This last, however, is now much diminished since the introduction of chloroform. These risks do not depend on the method of operation, and, so far as the incisions are concerned, may be termed unavoidable. The dangers incident to certain methods of operating are—hæmorrhage, infiltration of urine into the sub-peritoneal cellular tissue of the pelvis, and wound of the rectum. The last-mentioned occurrence, however, is rather a disagreeable accident than a danger; and indeed, as I have already stated, free incision of the rectum forms a necessary part of the recto-vesical operation. To these risks must be added the danger of bruising and lacerating the textures at the neck of the bladder and of the perineum, in attempts to extract forcibly a large stone through an insufficient opening.

To understand how some of the methods give a greater chance than others of avoiding some of these dangers, and how some of them, in trying to avoid one risk incur another equally dangerous, let us take a general view of the space in which any of the forms of perineal lithotomy must be performed, and the relations of the pelvic fascia to the deep incision in reference to the risk of infiltration of urine.

The perineal space, or inferior outlet of the pelvis, is not very large in the male; bounded in front by the pubic arch and sub-pubic ligament, laterally by the rami of the pubis and ischium and tuber ischii, laterally and posteriorly by the great sacro-sciatic ligament overlapped by the margins of the gluteus maximus of each side, and posteriorly by the coccyx, we have a diamond or lozenge-shaped space, which, for the sake of description, may be divided into two nearly equal triangles by a line drawn across the space from one tuberosity of the ischium to the other. The anterior is sometimes termed the urethral triangle, and corresponds more directly to the membranous and prostatic portions of the urethra and the neck of the bladder, the parts towards which our incisions in lithotomy are directed. The posterior or anal region of the perineum, the anterior part of which is implicated in the lateral and bi-lateral methods of lithotomy, is occupied in the centre, and to some extent laterally, by the anus and the lower pouch of the rectum, and the sphincter and levatores ani muscles, on either side of which we find the ischio-rectal fossæ, containing a quantity of fat and loose cellular tissue and the inferior hæmorrhoidal arteries and veins.

The widest part of the space, in reference to lithotomy, is between the tuberosities of the ischium. The measurement here is very variable. Dupuytren and Velpeau give its dimensions—the former as varying from 2 to 3½, and Velpeau from less than 2 to 4 inches. The general

average of my own measurements is rather less than that of others. When viewed as in lithotomy, the anterior space is bounded by the scrotum, and in the central line we remark the raised line or ridge and the faintness caused by the spongy part of the urethra. The space is covered by the skin and common superficial fascia: under this it is closed in by a dense layer of fascia, the true superficial fascia of the perineum. Under it we find the superficial perineal branches of the pudic artery and nerve, the accelerator urinæ muscle covering the bulb and spongy portion of the urethra and part of the surface of the anterior layer of the triangular ligament, and laterally, in close contact with the accelerator anteriorly, is the erector penis covering the crus penis. Posteriorly the transversus perinei muscle crosses the space from the tuberosity of the ischium to the central point of the perineum. If we now draw aside the erector penis, clear away the posterior fibres of the accelerator, and draw down or divide the transversus perinei, we perceive a dense aponeurotic structure. This is the anterior or superficial layer of the triangular ligament, which stretches across and closes the anterior part of the perineum, merely presenting an opening for the urethra. This triangular ligament consists of two layers which coalesce at the posterior boundary of the anterior triangle, but which are elsewhere separated for nearly the depth of half an inch. This interval between the layers is traversed from above downwards and forwards by the membranous portion of the urethra, and is occupied by the muscular fibres of the compressor urethræ, and a plexus of veins, whilst, about 16 lines in front of the anus, the artery of the bulb runs across the space from without inwards, close to the anterior layer of fascia, and immediately below it, and close behind the bulb the antiprostatic or Cowper's gland is situated.

If, at this stage of the dissection, we mark a line beginning about an inch and a quarter in front of the anus, close to the raphe, and passing obliquely downwards and outwards about midway between the anus and tuber ischii, we indicate the line of incision in the lateral operation of lithotomy, and we see the parts which must be divided to reach the triangular ligament. (Plate XXXVII, fig. 1.)

If the posterior margin of the triangular ligament or deep fascia be lightly touched with the knife, and the finger entered deeply about the middle of the line of the incision, and directed upwards and to the central line of the perineum, as if to reach the subpubic arch, the groove of the staff will be felt in the membranous part of the urethra, and you will notice that the artery of the bulb lies anteriorly and superficially to the part of the urethra into which the knife should be entered. If, on the contrary, you were to cut the triangular ligament as far forwards as the extent of your external incision, you would be very likely to divide the artery of the bulb. If you now examine the mesial line of the perineum, you will perceive that whilst it is the shortest and most direct route to the neck of the bladder from the perineum, there is only a very short space between the bulb and anus, and that this space diminishes between the bulb and rectum, as we pass upwards. Indeed, in many subjects, the bulb completely overhangs the membranous part of the urethra.

At the same time, however, you will observe that no important structures occupy the recto-urethral space, that the rectum can be easily pushed back, and that by dividing the muscles and other textures connected at the central point of the perineum, and by bulging forwards the convexity of the staff, the membranous urethra can be made easily accessible. Still, the mesial incision must necessarily be limited as compared with the lateral, unless we divide the anterior wall of the rectum, as in the recto-vesical operation.

We now remove all the muscular and other structures, leaving merely the posterior layer of the triangular ligament, and we can feel the prostate though we cannot see its form. We therefore dissect away the posterior layer of fascia, and this brings into view the thick anterior fibres of the levator ani descending on the sides of the prostate, and you will notice how these strong fibres will require division to some extent in lithotomy. Cut away part of the levator, and the contour of the perineal aspect of the prostate, enclosed in its fascial sheath, is seen, and its relation to the rectum and vesiculæ seminales. (Plate XXXVII., fig. 2)

We now turn from the perineum to the interior of the pelvis, strip off the peritoneum from the pelvic fascia, and clear away any fat with the handle of the scalpel. You now perceive that a lamina of the visceral layer of the pelvic fascia is reflected on the upper surface of the prostate, and from it upon the sides of the bladder, above that gland, so as to form a septum, as it were, between the upper and lower part of the pelvis. Looking from the pelvis you can see nothing of the perineal dissection. Looking from the perineum you can see nothing above the prostate; but if you pass the fingers of one hand from the pelvis, and those of the other from the perineum, you feel that they are only separated by this reflected layer of fascia, and you will understand at once how an opening in the prostate, if made either directly downwards, as in the median operation, or obliquely downwards and outwards, as in the lateral and bilateral methods, if not carried too transversely or too far outwards, beyond the base of the gland, will enable you to open the bladder, and extract a stone, without dividing this important barrier, so that the urine will naturally flow by the perineal incision, and cannot possibly reach the subperitoneal cellular tissue.

I have avoided entering on the complex descriptive anatomy and nomenclature, and all the connections of these fasciæ. I merely content myself with pointing out their relations and bearing on the incisions in lithotomy.

The dimensions, form, and structure of the prostate gland also demand our special attention, for the direction and extent to which we can carry our incision through its substances without dividing that part of its base where the reflection of the fascia takes place, forms one of the most important points in regard to lithotomy. The form of the prostate has been well compared to that of a chestnut. It surrounds the commencement of the urethra, at the neck of the bladder. The great portion of the substance of the gland lies posterior to the canal of the urethra, about one-third or one-fourth of its substance lying on the

anterior or pubic aspect of the canal. The prostate is placed somewhat obliquely, its apex directed downwards and forwards, whilst its body and base rest upon the rectum, the base as it were embracing the neck of the bladder, and connected with the vas deferens and vesiculae seminales, whose ducts pass into and through its substance. If we take the measurements of the prostate in different directions, we shall find that in the mesial line, from above downwards, from its base to its apex, it measures from twelve to fourteen lines in the adult, and that its longest axis on each side is from the apex, at the membranous part of the urethra, obliquely downwards and outwards, which gives a difference of from three to four lines more than the mesial measurement; and this direction is also that in which the incision is least likely to injure the reflection of the ileo-vesical fascia, as it runs lower down, and parallel to the line of reflection. Incisions made in similar directions, through both sides of the gland, will of course double the size of the opening in the prostate, and give us the largest aperture we can obtain consistently with the non-division of the base of the gland. But to understand how stones are readily and safely extracted by the ordinary lateral operation, though much larger than we should suppose the opening of the prostate would permit, we must consider the character of its structure.

The prostate, in its normal healthy state is soft and yielding, composed of a congeries of mucous follicles interspersed with a peculiar fibrous structure, which some anatomists consider as muscular, and these textures are enclosed in a very thin but strong fibrous capsule, which gives the gland its form and compactness. If we examine the gland where it surrounds the neck of the bladder, by dissecting off the



Fig. 219

mucous membrane from the commencement of the prostatic portion of the urethra, we find that at the opening of the bladder there exists a ring of dense elastic fibrous texture, about three lines in breadth and depth: and even in the dead subject, though the orifice of the urethra into the bladder can be dilated to some extent without incision, it will not yield beyond a certain point unless this dense ring be divided, and then we find that when it is cut the gland texture splits up in the direction of the cut with very slight force; this dense structure should always be divided in lithotomy, to enable us to enlarge the opening with the finger.

When we look at a dissection of the parts after lithotomy has been performed, it would seem as if the incision of the prostate were limited to the opening at the apex of the gland; but if we look from the interior of the bladder, we will see that the incision has traversed the

Fig. 219. Extent of prostatic incision, as seen from the interior of the bladder.

whole length of the prostatic urethra, and divided it, together with the elastic fibrous structure (fig. 219)—this is also indicated by the dotted line in the diagram of the lateral operation. (Plate XXXIX.) In looking at such a dissection you must moreover recollect that the prostate is enveloped in a sort of sac formed by the visceral layer of the pelvic fascia. We have seen that the ileo-vesical layer is reflected upon its base, and from it to the bladder, on the side the prostatic layer covers it and the vesiculæ seminales laterally, whilst between it and the rectum we find the recto-vesical layer of fascia passing across from one side

of the pelvis to the opposite. It is this fascial envelope which maintains the form and gives the appearance of a very limited incision; for, if we remove the parts, and dissect off the fascial covering, as in fig. 220, you observe that in most cases the limited incision made by the knife has split up under pressure of the finger throughout nearly the whole extent of the substance of the prostate, but leaving the resisting fasciæ entire; and you will thus understand how a large stone may be easily extracted through what at first seems a very limited opening. I need hardly remind you that in old people the prostate alters both in size and structure, and although its increased bulk en-



Fig. 220

ables us to make a larger incision in the gland, its altered indurated structure does not yield as in the healthy gland, and requires to be freely divided with the knife to enable us to extract the stone. In some cases I can only compare the sensation to that of cutting through a thick mass of india rubber. You feel at once that attempts to dilate or split it up would be useless.

The general position of the bloodvessels of the perineum requires your attention in reference to the different methods of performing lithotomy. The internal pudic artery, after re-entering the pelvis between the greater and less sciatic ligaments, courses along the deep surface of the tuberosity and ramus of the ischium and ramus of the pubis, and passes obliquely forwards and inwards in the perineum, to which region it gives off several branches, some of which it is of importance to avoid in lithotomy. At first the pudic artery is bound down to the surface of the obturator internus muscle by the obturator fascia, and when the fat is cleared from the ischio-rectal fossa, the vessel, if well injected, can be felt through the fascial covering, lying about three-fourths of an inch above the internal margin of the tuberosity, and protected by the bone. At this part of its course it could scarcely be wounded in lithotomy, unless the edge of the knife were not

Fig. 220. Extent of prostatic incision, after the fascial covering has been dissected from off the gland.

only lateralised, but turned towards the internal surface of the tuberosity. As the pudic passes forwards in the perineum, it gradually loses the protection of the ramus of the ischium, so that anteriorly, after giving off the artery of the bulb, it actually lies between the layers of the triangular ligament, and is here in danger of being wounded if the knife be withdrawn transversely, or too much outwards, after division of the prostate.

The pudic artery, as it passes forwards, gives off branches to the perineum. Where it lies in relation to the tuber ischii it sends off the inferior hæmorrhoidal artery, which divides into two or three small vessels which traverse the ischio-rectal fossa, and ramify on the lower part of the levator ani, and ultimately supply the lower part of the rectum. Some of these branches are necessarily divided, both in the lateral and bilateral operations of lithotomy, but seldom bleed much, and can be easily secured if they do. A little more anteriorly the pudic gives off the superficial perineal, a large artery which supplies the more superficial textures of the region, and ultimately passes to the scrotum. This vessel pierces the obturator fascia, turns round the transverse perinei muscle, giving off small twigs which run parallel to the edge of that muscle, then continues its course obliquely upwards and forwards, lying along the internal aspect of the erector penis muscle, and covered by the superficial perineal fascia. This artery must often be cut in the lateral operation, especially if the incision is not begun close to the raphé; but, as it lies superficially, it can be readily secured. M. Roux, however, observed, that if the surgeon lateralised his knife too much, and divided the artery near its origin, it might retract within the obturator fascia and simulate wound of the pudic; and when we consider that the vessel is stretched, by the scrotum being drawn up during lithotomy, I think that M. Roux's suggestion shows the necessity of beginning the incision close to the raphé, and not carrying it too far out towards the ramus of the ischium.

The branch of the pudic of most importance in reference to lithotomy is the artery of the bulb. This vessel arises from the pudic trunk, about sixteen lines in front of the anus, and crosses the perineum between the layers of the triangular ligament, sends off a small twig to Cowper's gland, and then enters the spongy portion of the urethra, immediately above the pendulous portion of the bulb. It is in general a short vessel, about the size of one of the digital arteries. On entering the spongy portion of the bulb it immediately subdivides into numerous minute twigs, which assume the peculiar arrangement of the erectile texture. It is not so much the size as the depth of this vessel, and its short origin from the pudic, that render it so dangerous a source of bleeding if wounded in lithotomy. In the ordinary lateral operation, if we begin our incision not further forward than an inch and a quarter, or an inch and a half in front of the anus, and close to the raphé, and take care to divide the base of the triangular ligament low down, and then to push the finger upwards, as I pointed out when describing the perineal dissection, so as to feel the staff immediately in front of the prostate, there is no risk of this vessel being wounded if

It occupies its normal position. The terminal branches of the pudic have no relation to the incisions in lithotomy, if their distribution be normal; and at present, in considering the avoidable risks, I do not enter on the abnormal sources of hæmorrhage; but in regard to these, I would refer you to a paper I published on the sources of hæmorrhage in lithotomy in the *Edinburgh Medical Journal*, March 1842, vol. i. See reprint after Clinical Cases.

Venous bleeding from the large prostatic veins in old men is a risk incident to all forms of perineal lithotomy; but it is not of frequent occurrence. The risk of phlebitis from irritation of these veins must, however, be kept in mind.

As regards wound of the rectum, I would merely observe that it is not in our first incisions that the gut is in danger. For a short distance above the anus the rectum becomes somewhat contracted, and curves back from the bulb and urethra. The part of the operation at which there is most risk of wounding the bowel is either in opening the membranous portion of the urethra, carrying the knife onwards through the prostate, or in enlarging the wound in withdrawing the knife from the prostatic incision. At this deep part of the wound the rectum is distended into a large pouch; and I confess that it is a wonder to me how the bowel escapes injury; yet the accident is a very rare one—indeed I cannot recollect ever having seen it happen: and what has also struck me as remarkable is, that though urine must constantly pass over the portion of the rectum where it is exposed in the upper part of the track of the incision, I never knew of a case in which ulceration in the gut occurred after lithotomy.

LECTURE CIX.

Perineal Lithotomy, *continued*—Preliminary arrangements—Celsian Operation “on the Gripe”—Operation by the “Apparatus Major”—Lateral Operation as introduced by Frère Jacques—Description of the Modern Lateral Operation—Modifications of the Operation—Lateral Lithotomy in Children—Lithotomy in Patients who have been previously operated on—Bilateral Lithotomy: Advantages in certain cases.

HAVING directed your attention to the anatomy of the perineum in so far as it is connected with lithotomy, I now proceed to consider the different methods of performing that operation.

In lithotomy, besides the preliminary treatment common to all great operations, there are some special preliminaries to be attended to. On the day before the operation the perineum should be shaved, and the patient should have a dose of castor-oil to open the bowels. About two hours prior to the operation, an enema of warm water should be administered, to clear out any feculent matter from the rectum. I generally advise the patient to take a draught of water about half-an-hour before the operation, so as to have a moderate amount of urine in the bladder; but if the patient cannot retain his water, or if the urine is passed as he comes under the influence of chloroform, the safest plan is to introduce the catheter, draw off the remaining urine, and inject about six ounces of tepid carbolic water into the bladder. This plan I now uniformly adopt in my own practice. The patient should be placed on a firm table, about $2\frac{1}{2}$ or 3 feet high, and the stool for the operator to sit on should be about a foot lower. In children there is no necessity to tie up the patient, the limbs are held in position by assistants; but in adults the patient must be properly secured. At one time this was done by means of long bandages, or lithotomy garters, as they were termed, wound round the wrists, hands, and ankles. All that is requisite, however, can be accomplished by the short lithotomy loop or garter represented in plate XXXIX., fig. 4, applied as shown in fig. 1 of the same plate. This garter is fastened as follows.—The wrist is passed through the loop, which is then tightened, the assistants bend up the leg, and draw down the arm till the wrist is opposite the centre of the foot. The free ends of the garter are then passed, one over the dorsum and the other under the sole, and tied firmly on the inside of the foot. If this be properly done and firmly secured, it will be found quite sufficient. The knees are then separated, and the limbs and pelvis maintained in the proper position by two assistants, one on each side.

Special attention should be had that the pelvis is placed even, the patient lying over the edge of the table. As a general rule, it is advisable that the staff should be introduced before the limbs are last.

The instruments required will vary somewhat according to the method to be adopted, or any modification of the operation. In general terms, however, the apparatus required is a grooved staff; a sharp pointed lithotomy knife; a probe-pointed knife for enlarging the deep incision, should that be required; different forms of lithotomy forceps, and scoops for the extraction of the stone; and a gum-elastic tube, to be kept in the bladder after the operation. Besides these instruments there should always be at hand a Reade's injection syringe or other injecting apparatus, with tubes, for injecting water into the bladder previously to operating, or for washing out the bladder should the stone break during extraction; and of course the ordinary apparatus of artery forceps, ligatures, etc.

When lithotomy was first performed it was done without any reference to anatomy. All that the operators thought of in those days was to get out the stone by the easiest and most direct method.

In the earliest or Celsian method, the surgeon introduced his fingers into the rectum, and tried to grasp the stone and press it into the perineum till it formed a projection there. He then cut down upon the swelling in the perineum till his knife grated on the stone, and removed it either by tilting it out from behind by his fingers in the rectum, or by means of hook or lever. This simple method was called "the operation of the gripe," or operation by the APPARATUS MINOR, and continued to be performed by some surgeons even till a comparatively recent period. In many cases this method of operating was successful, but in others quite the opposite. It was a very uncertain operation; for, whilst in some cases the parts divided to reach the stone might be those proper to be cut, in others the prostate might be completely divided, or the bladder cut above the prostate, or a portion of the rectum might be projected before the coats of the bladder, and a fecal fistula result from its division. In truth, it was a mere matter of chance what parts were projected before the stone. There must always have been great risk of infiltration of urine occurring after such an operation. (See woodcut at end of Lecture.)

An Italian surgeon, Joannes de Romanis, introduced a method of operating which was considered of a scientific character, founded upon an axiom of Hippocrates, "that wounds of the bladder are always fatal." This method was adopted by the family of Collet, in Paris, and continued to be practised by them for many years.

To avoid cutting the bladder, these surgeons began their incision in the anterior part of the perineum, and opened into the spongy part of the urethra, at or in front of the bulb, and then dilated, or rather tore open, the textures of the perineum, the membranous and prostatic urethra, and the neck of the bladder, till the aperture was large enough to enable them to extract the stone. This was termed the method by the "APPARATUS MAJOR." One of its principles was "a small incision and large dilatation." And, properly understood, this is one of the

principles of lithotomy in the present day. This was really extensive and deep-seated laceration, and used two instruments, at first merely as gouges, and afterwards converted into powerful dilators. The urethra and prostate were either separated from the bladder, or so torn up as at last to enable the stone to be extracted. Subsequently compound dilators were used, which give enormous power to the surgeon, and with these the parts were still more torn and lacerated than before. This method, though very fatal, was more successful than we should expect, for, considering the force used, and the way in which the parts were torn and bruised, the wonder is that any survived.

The operation on which the present lateral operation is founded, was introduced into France by an itinerant monk, the famous Frère Jacques. His operation, as he first performed it, though it was rapid and successful in regard to extracting the stone, was uncertain in its results, owing to want of precision as to the parts cut in opening the bladder. He used a sound without any groove, and having passed that into the bladder he plunged a dagger-shaped knife into the perineum, close to the left tuber ischii, carrying it deeply towards the sound in the neck of the bladder, and at the same time cutting forwards in the perineum and inwards towards the raphé, so as to make a cut much in the position of the ordinary lateral incision. The stone was then extracted with the forceps or hook. This operation, like that of the gripe, was very uncertain, but it proved so much more successful than that by the apparatus major that it attracted the attention of surgeons, who taught Frère Jacques the anatomy of the parts. He then substituted a grooved staff for the plain sound, and made his incisions more methodically. His later operations were eminently successful, the number of cases on which he is said to have operated in different parts of the Continent seems almost fabulous.

It is very curious that the instruments which I show you, which are those still used by the native operators in the North West Provinces of India, are almost identical with those employed by Jacques in his first operations, namely, the ungrooved staff, dagger-like knife, and forceps, with one handle in the form of a lever hook.

I shall now describe and demonstrate the method of performing the LATERAL OPERATION OF LITHOTOMY with the curved staff and knife.

The staff should be made of steel, grooved obliquely on the left side, between its convexity and concavity. The knife I prefer is that known as Liston's knife, moderately broad in the cutting part of the blade, sharp, but not too long in the point, and bevelled off at the back, near the point, so as to glide readily in contact with the groove of the staff. The cutting edge extends only for about an inch and a quarter from the point, the part nearer the handle being blunted. (See plate XXXIX, fig. 3.) The forceps require to be of different shapes, curved and straight, some with flattened, others with more hollowed blades, so as to grasp firmly different forms of stone, and some, so

designed that the blade can be introduced separately to enclose the stone, and then locked by a sliding joint. The scoop should have one end straight and the other curved, so as to act as a lever hook. The length of the tube must vary in length according to the depth of the bladder. In ordinary cases four or five inches will be sufficient. Before the operation a circle of cotton bandage is fastened round the abdomen, to which the tapes of the tube are secured after the operation is completed.

I shall now suppose that all the preliminaries have been attended to, and that the staff has been introduced, and the patient placed in the proper position. The operator, seated before the patient, passes his finger into the rectum, feels the position of the staff, the relations of the prostate and membranous part of the urethra, and having finally adjusted the staff gives it to the assistant to hold. It should be kept steady, without any inclination of the handle towards the abdomen, and, in general, in contact with the stone in the bladder. The position of the staff is all important, more especially in children, or in cases of enlarged prostate in old men, for if the handle be inclined towards the belly the point of the staff may be withdrawn from the bladder, and lead to awkward or even serious results.

Having adjusted the position of the staff, and committed it to the

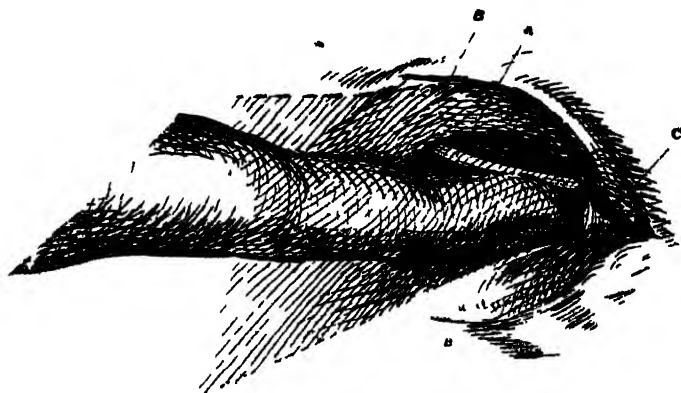


Fig. 221.

assistant, who holds it with one hand, and draws up the scrotum with the other, the surgeon feels the space between the raphe and the tuber ischii, inserts his knife close to the left side of the raphe, about an inch and a quarter in front of the anus, and cuts obliquely downwards and outwards, so that his incision terminates at or a little beyond the lower margin of the anus, and about midway between the anus and tuber ischii, or rather nearer the tuberosity. I believe a great deal depends on the way in which this incision is made. The knife should be inserted deeply at first, and the incision deepened as it passes backwards. We shall thus have a clean decided cut, which should divide the skin.

Fig. 221. The forefinger following the grooved staff along the prostatic incision into the bladder.

fat, superficial fascia, and the transversus perinei muscle. The surgeon then runs the edge of his knife lightly over the remaining areolar and fascial textures, and, inserting the forefinger of his left hand about the middle of the incision, pushes it upwards in the direction of the sub-pubic arch. The soft textures are readily displaced by the finger, and he feels the groove of the staff thinly covered, just in front of the prostate. He turns the pulp of his left forefinger towards the



Fig. 222



Fig. 223

staff, and inserts his nail in the lower margin of its groove, and, guiding the knife over his left forefinger, lodges its point in the groove, and feels it fairly in contact with the metal of the staff. He then lateral-



Fig. 224



Fig. 225.

ises the blade, and, keeping the back of the point of his knife in close contact with the staff, carries it steadily along the groove, through the prostate, till the point of the knife is arrested by the termination of

Fig. 222 Shows the direction in which the forceps should be introduced to seize the stone.

Fig. 223. Direction in which extraction should be effected.

Fig. 224. Use of the scoop in removing small calculi or fragments of a stone.

Fig. 225. Position of the lithotomy tube. When the tubes are secured the external orifice of the tube should be raised so as to depress the point into the "bag-fund" of the bladder.

the groove (fig. 221). He now feels all resistance cease. The surgeon then withdraws the knife steadily from the prostatic incision, without cutting laterally; but as he withdraws it from the more superficial part of the wound, he presses aside the rectum and cuts downwards and outwards, and divides any resisting texture which may have escaped division in cutting towards the staff. The operator then glides his left forefinger along the staff, through the prostatic incision into the bladder, and by a gentle lateral and downward movement he dilates or splits up the prostate, and touches the stone. If satisfied that the incision is sufficient to permit extraction, he desires the assistant to withdraw the staff, and then introduces the lithotomy forceps along his finger into the bladder. On introducing the forceps the urine generally comes away with a gush, and, if the blades of the forceps be opened when just within the bladder, the stone is frequently carried between the blades and caught at once; but the forceps should never be opened suddenly, nor until fairly lodged in the bladder, lest they should tear the prostate or neck of the bladder. If the stone is not caught as above described, the points of the forceps should then be directed downwards and backwards till they touch the stone; their blades are then opened so as to seize it (fig. 222). When the calculus is fairly grasped, the direction of the forceps is altered, the handles are depressed, and the extraction effected by drawing from above downwards, in the axis of the outlet, and towards its widest part (fig. 223). If a number of small calculi or fragments of stone require to be extracted, the scoop should be used, as shown in fig. 223. When the stone has been extracted, the surgeon should carefully examine the bladder, both with his finger and the bulbous searcher, to make sure that no other stones or fragments of stone remain. He then examines the wound to see if any vessels require to be secured; and finally inserts the gum-elastic tube, and secures it to the bandage round the waist.

When the lateral operation is performed, as above described, we have a funnel-shaped incision passing from below upwards, gradually diminishing in extent towards the neck of the bladder, and forming a free dependent outlet for the urine to flow by after the operation. The deep or prostatic incision, though limited in comparison with the superficial wound, is yet in such a direction as to give the longest diameter of the left lateral half of the prostate gland, without dividing the ileo-vesical layer of fascia, and amply sufficient to permit the safe extraction of a tolerably large stone. (Plate XXXVII., fig. 2; also plate XXXVIII., figs. 1 and 2.) The lower part of the triangular ligament, and the other fascial and muscular structures closing the outlet, in the line of the incision, are fairly cut, and oppose no obstacles to the introduction of the forceps or the extraction of the stone. If the incision is placed low and made in the manner directed, neither the artery of the bulb nor the pudic trunk can be wounded if in their normal position, and even the superficial perineal can scarcely be cut, its small transverse twig and the anterior hæmorrhoidal branches being the only vessels divided; so that the risks of infiltration of urine and of hæmorrhage are almost at the minimum; whilst, by care in using the knife,

and by pressing the rectum aside with the left forefinger in making the deep incision and in withdrawing the knife, wound of that intestine is not likely to occur, and in point of fact is a very rare accident. I therefore consider that the lateral operation of lithotomy is in general preferable to any of the other methods.

I have described the steps of the operation as usually performed, but various modifications are used by different surgeons, and numerous instruments have been devised to overcome difficulties, or with the intention of giving precision to the incisions. The different mechanical devices seem to me to resolve themselves into two general forms—first, Those intended to facilitate finding the groove in the membranous part of the urethra, and carrying the knife easily along the groove without risk of its slipping downwards in taking the curve. Amongst these devices we have Earle's double staff, to enable the operator to cut directly from the skin into the urethra, a thing which no one now thinks of. And more recently we have Aston Key's straight staff, and Buchanan's rectangular staff, both of which enable the operator to run his knife very easily into the bladder, and by attending to the angle formed by the knife to regulate the extent of the prostatic incision. The second series of mechanical contrivances are the most numerous, and are those intended to ensure making the incision of the prostate of a determinate size. Such are the different forms of gorgets and broad knives, cutting only to a limited extent, to be used for the prostatic incision, such as those of Desault, Cooper, Brodie, and Syme, and the lithotome caché. But, except in some cases of enlarged and rigid prostate, where a bluntish-edged gorget or the probe-pointed knife may be useful to enlarge the prostatic incision, the ordinary lithotomy knife is far safer. I have never used any of these instruments on the living, but I have tested most of them on the dead subject, and I feel satisfied that none of them gives such a perfect prostatic incision as the knife if properly used. In regard to the rectangular staff of Dr. Buchanan, I believe it to possess some decided advantages if used with the ordinary lateral incision. Every one must admit that it is much easier to carry the knife along a straight director, such as that formed by the horizontal limb of the rectangular staff, than to make it follow the curve of the ordinary staff; and if care be taken not to bulge forward the angle of the staff, so as to make it superficial, but to keep it held like the ordinary staff, the groove will be readily felt, and the knife run along it with great ease and certainty into the bladder, and without risk to the artery of the bulb, as I have repeatedly tested on the subject. Were I to make any change on the instruments I have been accustomed to use in operating on the living, I should be inclined to adopt the rectangular instead of the curved staff, but not to alter the line of the lateral incision. I have during the last six years frequently performed the lateral operation, using the rectangular staff. In children, and in adults in whom there is no great enlargement of the prostate, this staff greatly facilitates the carrying of the knife through the prostate into the bladder, and gives precision to the prostatic incision; but when the prostate is much enlarged I prefer the curved staff, as I have found in some cases that when the angle of the rectangular staff

was in the membranous portion of the urethra, the point was not in the bladder, whilst if the horizontal limb of the staff be made long, to meet the difficulty, it is very troublesome to introduce in these cases. In such conditions, the large curved staff should be used, as it is easy to introduce, and the groove is easily followed.

In referring to the mode of feeling for and inserting the knife into the groove of the staff, I have described the method usually followed; but I very generally use the forefinger of my right hand, with the knife laid flat upon it, the back of the blade toward the left side, and the point advanced to the pulp of the finger. With the knife so placed and protected, I pass the forefinger into the wound till I feel the groove of the staff in the membranous portion of the urethra, and then, when the pulp of the finger rests in contact with the groove, I project the point of the knife into it by a slight movement of the thumb, and at the same moment turn the finger laterally, then withdraw my finger along the blade and handle, keeping the forefinger below the blunt part of the lower edge of the blade, so as to prevent the possibility of the point slipping out of the groove in taking the turn at the curve of the staff. The movements described are executed instantaneously, and almost imperceptibly, and ensure the knife being easily inserted into and carried along the groove, especially in a deep perineum. In ordinary cases the method formerly described answers well enough.

LATERAL OPERATION IN CHILDREN.—In performing the lateral operation on young children, it is important to keep in mind that the bladder lies high up, and that, from the small size of the staff, great care is requisite to open into the groove, and still greater care in carrying the knife onwards into the bladder. From the small size of the urethra and prostate they are easily lacerated; the delicate membranous urethra may easily be separated or torn from the prostate, if the knife or finger be pushed on forcibly, and the prostate and bladder pushed above the pubis. The sensation of the knife grating along the groove should never be lost for an instant till the bladder is opened. Another rule specially to be attended to is, that when the staff is introduced into the bladder, and the stone touched by it, it should be held in contact with the stone from first to last, and the surgeon should never desire the staff to be withdrawn till he feels the stone distinctly with his finger. If these directions were attended to, the accidents, of which we sometimes hear, of lithotomy being performed and abandoned after efforts at extraction, and of the bladder after death being found unopened by the incisions, could not occur. The real causes of such misfortunes seem to me to be, either that the point of the staff has slipped from the bladder, and so misguided the knife, or that the knife has slipped from the groove in taking the curve, and thus, when the operator passes up his finger, the loose cellular tissue between the bladder and rectum is broken up with the finger, and he mistakes it for the cavity of the bladder, and feeling the stone perhaps through the thin coats of the bladder above, he makes futile attempts at extraction. I repeat, the staff should never be removed,

nor the forceps used, till the surgeon feels the stone distinctly with his finger.

In extracting the stone, either in the adult or child, it occasionally, though rarely, happens that it slips from the forceps after having passed the opening in the prostate. In such circumstances the operator should insert his finger into the rectum, so as to fix the stone from behind, and prevent its slipping back, and then with the curved lever end of the scoop draw or tilt it out of the wound.

It occasionally happens that a patient who has been the subject of

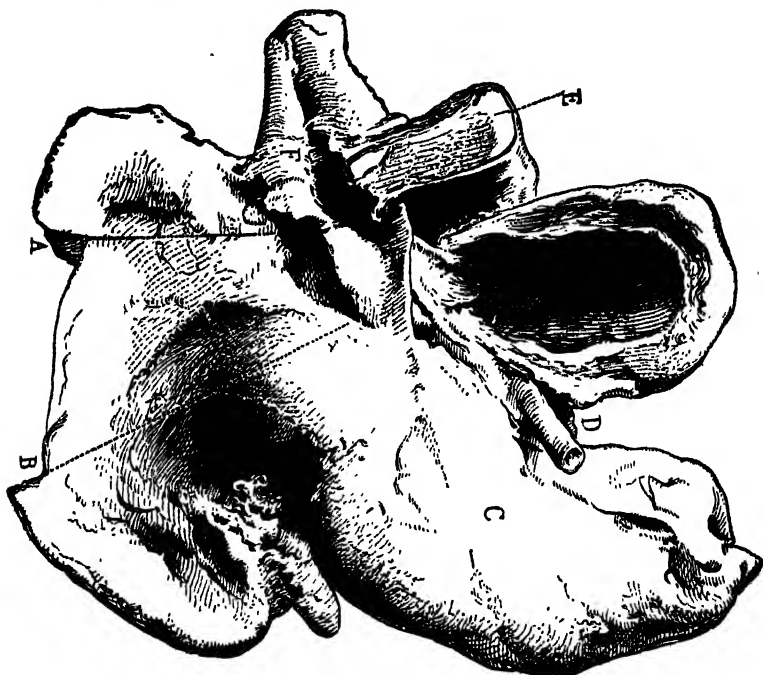


Fig. 226.

lithotomy is again affected with calculus, and requires to be again operated on. In such circumstances it has been advised that the incision should be made on the right side of the perineum, and the right lateral lobe of the prostate divided. The reason assigned for this recommendation is, that the textures formerly cut will be so condensed and resistant as to render their division and the extraction of the stone

Fig. 226. A lateral view of the pelvic viscera (natural size) of a young child on whom the lateral operation had been recently performed. A B and the dotted lines proceeding from these letters mark the track of the wound, from the surface to the incision of the membranous portion of the urethra and prostate, and show the great depth of these last-named parts from the surface in the child, due to the high position and elongated neck of the bladder. D is the section of left ureter, somewhat enlarged. E is the section of the pubis to the left of the symphysis, so as to retain the relations of the prostate and reflection of the ileo-vesical fascia. F the spongy and bulbous portion of the urethra. C the rectum.

very difficult. I have had occasion to operate on a patient fifteen years after he had been operated on for stone by another surgeon. The patient was a big, stout man, above sixty years of age, with all the appearance of a very deep perineum. I performed the ordinary lateral operation, dividing the old cicatrix, and not only met with no difficulty, but feel satisfied that the textures were atrophied so as to render the perineum shallower, whilst the prostate, usually rigid in old men, offered no resistance, the incision yielding easily to the pressure of the finger. In a word, the operation was easier than usual in performance, and there scarcely was a tablespoonful of blood lost. So that, in such cases, I see no reason for performing lithotomy on the right side of the perineum.

The BILATERAL OPERATION of lithotomy, as its title implies, has for its object the section of both lateral lobes of the prostate, so as to give a larger opening at the neck of the bladder, without division of the fascial structures which oppose the risk of urinary infiltration. In performing the lateral operation, it has long been a rule with surgeons, when the stone was found of a size larger than was likely to be easily extracted by the section of the left side of the gland, to divide the right lateral lobe with a probe-pointed bistoury. Baron Dupuytren, however, proposed the special operation as the safest, and therefore the preferable method in all cases, as he considered it diminished both the risk of infiltration and hæmorrhage; and, by giving the largest possible opening in the prostate, avoided the risks arising from bruising the deep textures in extracting the stone, and the line of the external incision was intended to correspond to the double incision of the prostate. The bilateral operation of Dupuytren is, as described by himself, the Celsian lithotomy (see tailpiece at end of Lecture), performed on anatomical and scientific principles. The external incision is placed rather less than an inch in front of the anus, and is of a curved form, the concavity of the curve looking back towards the anus, the horns of the incisions directed towards the hips, and about $2\frac{1}{2}$ or $2\frac{3}{4}$ inches in extent. A staff, grooved on the centre of its convexity, and somewhat more curved than the ordinary staff, is introduced prior to the operation being commenced, and held in the usual manner by an assistant. The incision I have described divides the skin, fat, and fasciæ, down to the muscles and central point of the perineum. The connections of the sphincter ani and other muscles at the central point are divided, the lower part of the rectum pushed backwards, and the bulb of the urethra pressed forwards. The forefinger of the left hand is then passed deeply at the centre of the wound, to feel the groove of the staff in the membranous part of the urethra, and from the very convex form and open groove of the staff, it is usually easily felt. The membranous urethra is then opened freely, so as to expose the groove, and the operator inserts the beak of the double lithotome caché—a special instrument for double section of the prostate. The closed lithotome is glided along the staff with its concavity towards the groove, until it is felt to enter the bladder and touch the stone; then the concavity of the lithotome is turned back

towards the posterior surface of the bladder and prostate. The staff is, in general, withdrawn, so soon as the surgeon satisfies himself that the lithotome has touched the calculus in the bladder. The extent of the prostatic incision is determined by adjusting the projection of the blades of the lithotome previously to the operation, by means of a screw moving on a graduated scale. The concavity of the lithotome having been turned towards the inferior aspect of the bladder, and having its beak projecting within the cavity, the operator then opens the blades by pressing on the lever spring at the handle, and withdraws the instrument steadily downwards through the external incision. The prostatic incision is then gently dilated by the finger, the forceps introduced, and the stone extracted, as in the lateral method. I have never performed this operation on the living. In some cases where the calculus was large I have divided the right side of the prostate with the probe-pointed bistoury, and in ordinary cases I have found this to answer well enough; but in a case in which I had to operate lately, where the stone was of a very large size and of a disc-like or circular form, lying across the cavity of the bladder, which it nearly filled, I found great difficulty in seizing and extracting it, even after free division of the right side of the prostate and enlargement of the lateral incision, owing to the obliquity of the stone in reference to the lateral incision; and I feel satisfied that the bilateral operation, with the external incision somewhat modified, would render the grasping and removal of the stone much easier. Moreover, I think every surgeon who has had to enlarge the prostatic incision by cutting the right side of the gland with the probe-pointed knife, must have felt a want of certainty as to the exact extent and direction of this second incision; whereas the double lithotome, as now improved, makes a perfectly smooth incision, passing equally through each side of the gland obliquely downwards and outwards in its longest diameter. My objection to the external incision of Dupuytren's method is, that it really does not correspond to the prostatic incision, is very limited in extent, and does not afford a free exit for the urine. The semilunar incision no doubt is intended to present two dependent points at the horns of the crescent; but if we look at the external incision when completed on the subject, or in the representation given of it in the posthumous work of Baron Dupuytren, edited by M. Sanson, we see that the wound is no longer crescentic, that the skin towards the anus stretches across in a straight line forming the chord of the arc, so as to prevent the urine escaping readily. Were I to perform the bilateral operation, I should begin the external incision about an inch in front of the anus, and then carry it obliquely downwards and outwards, as in the lateral operation, first on the left and then on the right side of the perineum, so as to form two oblique lateral incisions converging at the raphé. Such a form of incision would give greater space for extraction of a large stone; and, by corresponding to the direction of the bilateral section of the prostate, would permit of a free exit for the urine. In other respects, I should follow the steps of Dupuytren's operation, as already described.

Shortly after the first edition of this work was published, I carried out the plan above described in a patient who suffered from a large stone; but I found that the double lithotome did not divide the resistant prostate regularly as I had expected. I had to use a probe-pointed bistoury to complete the prostatic incisions; and in a subsequent case I extracted a larger stone with greater ease by the lateral operation.



CELSIAN OPERATION. LITHOTOMY "ON THE GRIP." APPARATUS MINOR.

LECTURE CX.

Lithotomy, *continued*—Mesial Operation—Recto-vesical Operation—Points to be attended to in regard to Extraction of the Stone—General After-treatment—Hæmorrhage—Infiltration of Urine after Lithotomy—Suppression of Urine—Inflammation of the Neck of the Bladder—Pyæmia—The Author's experience of the results of Lithotomy Cases—Remarks on Statistics of Lithotomy—Lithotomy in the Female.

It now only remains for me to describe the two forms of the mesial operation, which I must do very briefly. The simple *Mesial Operation of Lithotomy* is performed as follows:—A staff, somewhat similar to that used in the bilateral operation, is introduced into the bladder, and given in charge to an assistant, and the patient is then secured in the usual manner. The surgeon commences his incision about an inch and a half in front of the anus, exactly over the central line or raphé, and continues it back till within a few lines of the anus. This incision is carefully deepened anteriorly until it exposes the posterior part of the accelerator urinæ muscle covering the bulb, and the posterior fibres of that muscle are divided in the middle line, and the bulb pressed forwards and guarded by the finger, the rectum pressed backwards, and the finger feels for the staff in the membranous part of the urethra. The point of a narrow knife is now entered into the groove of the staff, with the back of the blade directed towards the rectum. When the knife is felt to have entered the bladder, the cutting edge is turned back towards the lower surface of the prostate, and carried down through the substance of that gland exactly in the middle line, the rectum being at this stage protected, and pressed back with the forefinger of the left hand. The wound is next dilated with the finger, and when the stone is felt the staff is withdrawn, and the forceps or scoop introduced and the stone extracted. In some respects this operation might seem the simplest, and as most completely avoiding the risks of infiltration and hæmorrhage. The incision of the prostate cannot implicate the reflexion of the pelvic fascia. There are no vessels in the central line of the perineum to cause bleeding, the only risk being wound of the bulb if not properly guarded, and the opening towards the neck of the bladder is direct and shallow. But then the space for extraction is very small. The fascial and muscular textures closing the outlet being, as it were, merely separated in the mesial line, not divided, oppose resistance to the free use of the forceps and the easy extraction of stone, so that even on the dead body the extraction of a stone of very moderate dimensions is attended with the sensation

of drawing a tight cork from a bottle. The late Mr. Allarton, who, some years ago, tried to revive this method of operating, considered that, by merely notching the apex of the prostate, the prostatic portion of the urethra and neck of the bladder could be dilated without further cutting; but from repeated trials on the dead bodies of adults I found that no stone could be extracted in that way, except of such a size that it could have been easily removed by lithotrity. I consider the mesial operation, though apparently simple, to be really more dangerous, and less suited for extraction of a moderately-sized stone than the lateral method.

The other form of mesial operation—the Recto-Vesical—is one which has been practised principally in Italy, and by some surgeons in this country, apparently with success as regards safety to life; but it is so obviously liable to the risk of being followed by recto-vesical fistula, that it is not likely to be adopted, except in special cases, to enable us to extract a large calculus through the widest part of the outlet of the pelvis, or where, as happened in one of Mr. Liston's cases, a portion of a large stone is sacculated and fixed between the bladder and the rectum.

The steps of the operation are very simple. The staff having been introduced, and the other preliminaries attended to, the surgeon begins his incision as in the mesial operation, but carries it back to the verge of the anus. He next dissects towards, and opens the membranous part of the urethra, and runs his knife along the groove of the staff into the bladder. He now introduces the forefinger of his left hand into the rectum above the base of the prostate, to guide the knife. Next, by raising the handle of the knife, he depresses its point, so as to puncture the bladder immediately above the base of the prostate, and then placing his left forefinger so as to press on the projected point of the knife, he carries it down, dividing the anterior wall of the rectum, prostate, sphincter ani, and intervening structures in the central line. Or he may proceed in a different and more summary manner. Placing two fingers of the left hand in the rectum, as for puncture of the bladder, the surgeon feels the groove of the staff above the base of the prostate, and then introducing a long sharp-pointed curved bistoury flat upon the fingers, he turns its point forwards, punctures the bladder in the groove of the staff where it is felt above the prostate, and by throwing back the handle of the bistoury carries its point forwards along the groove into the perineum, projects it through the skin about an inch in front of the anus, and then drawing the blade towards himself, lays the track of the wound through the bladder, urethra, and rectum, freely open. Through this large wound any stone that can possibly pass through the inferior outlet of the pelvis may be extracted; and whilst few will be found who would follow this method as a general plan, I should undoubtedly prefer it to the high operation for the extraction of large calculi, except in cases of greatly enlarged prostate, and, as I have stated, the results in regard to safety to life, and even as to the healing of the recto-vesical wound, are more satisfactory than we might have expected. The risk of hæmorrhage must be kept in mind, for bleeding from branches of the middle and inferior hæmorrhoidal arteries

or from the inferior part of the prostatic plexus, is liable to occur, but from the size of the opening the bleeding, if noticed, can in general be easily arrested by ligature or pressure.

Before concluding the consideration of the operative procedure in lithotomy, I would draw your attention to the important point of extraction of the stone. In most cases, if the stone is of a moderate size, and if a clean incision has been made, sufficient to admit of the easy introduction of forceps of sufficient size and grasp, and if these are introduced and used as directed, and as indicated in the diagrams in figs. 222-224, page 1096, you will generally meet with no difficulty in seizing and extracting the stone. But when the stone is large, or the perineum very deep, as in the case of enlarged prostate, the difficulties are increased, and in some rare cases the stone may be so placed as to require the use of curved forceps. In my own practice I have in three instances only met with difficulty in extracting the stone. In one of these the patient had an enormously enlarged and rigid prostate and very deep fat perineum, and the difficulty was not, properly speaking, in the extraction of the stone—a small flat one—but in feeling it with the forceps to seize it. It was easily felt with the sound and staff, but it lay flat in the bas-fond of the bladder behind the prostate, and even the curved forceps reached it with difficulty, and the bladder was far beyond the reach of the finger. The patient recovered from the operation, but died about four months afterwards from a paralytic attack, so that I had an opportunity of obtaining the parts, which are in my museum. The track of the wound is still visible, though contracted to a mere line, and the measurement from the external incision to the opening in the bladder is fully six and a half inches, even in the dissected preparation. With the exception of that case, which occurred many years ago, I had met with no difficulty in extraction, though I have removed some large calculi, until six years ago, when I met with two cases. In both of these the perineum was deep, but not of the excessive depth of the case I have mentioned. In one of them the difficulty in seizing the stone was principally due to my neglect of a precaution which I generally take, of making sure of the bladder containing a moderate amount of fluid. The incisions were rapidly effected, but when I introduced my finger and felt the stone, I found that there was very little urine, and that the bladder was contracted so as to render the use of the forceps difficult. The stone—a large flat one—was resting in close contact with the left side of the bladder, and I felt that moving about the forceps would do no good. I therefore introduced the curved lever, and displaced and seized it with a pair of curved forceps, and extracted it without using any force, and without perhaps any very great delay; but I believe that had I injected the bladder before the operation, the stone would have been seized and extracted with ease. The third case was one of real difficulty, owing to the large size and form of the stone, and the position it occupied in the bladder. The patient had suffered from symptoms of stone for above thirty years, and had a contracted perineum and ankylosed hip-joint, owing to old-standing disease of the hip. I felt the stone to be a large one, but never could form a very

decided idea of its size. It did not feel very thick, and indeed was only an inch and a half thick in the centre, and much thinner at the edges; but it was nearly circular, being 3 inches 5 lines in one diameter, and 3 inches 2 lines in the other. It lay obliquely across the bladder, which was small, and nearly filled by the stone. I felt it was too large to pass through the single lateral incision of the prostate, and therefore divided the right lateral lobe of the gland also; but, from the position which it occupied, it was difficult to open the forceps so as to seize it, and when seized, the raised centre of the stone did not give a very secure grasp, and it slipped several times before I succeeded in extracting it. As a general rule, extraction of the stone is not difficult. If the stone be not caught at once, however, two errors of opposite kinds may be made,—the forceps may be passed too deeply into the bladder, overshooting the stone, or in trying to avoid this they may not be passed sufficiently below it, so that the blades merely catch the end of the stone and do not grasp it fairly. In ordinary cases the position of the stone can be felt with the finger, and then, when the forceps are introduced and touch the stone, by gently opening the blades and pressing one of them against the posterior wall of the bladder, so as slightly to shake the parts, the stone will often fall within their grasp. Or, after feeling the stone with the closed forceps, by turning the blades away from the stone, and then opening them, and making a half-turn over in the direction of the stone, you will generally seize it. In some cases there can be no great risk in opening the blades pretty widely, and drawing them gently over the inferior and posterior surface of the bladder, to catch the stone; but I have a great objection to sudden plunges, or opening and shutting the forceps rapidly in hope of seizing the stone, as that is apt to injure the coats of the bladder.

In regard to the after-treatment of lithotomy cases, there is not much to be said. A dry warm "drawsheet" should be placed under the patient. The pelvis and body so placed on an incline of pillows as to favour the flow of urine from the wound. A saucer or sponge is placed to receive the urine, and the nates should be smeared with lard, or a mixture of lard and vaseline to prevent the skin becoming excoriated by wetting. If hæmorrhage comes on after reaction, it must be arrested by tying the bleeding vessels if necessary; or by ice bags applied to the perineum; if deeply seated and venous, slips of lint may be pushed up along the sides of the tube to control it. In most cases all that is required is to give the patient an anodyne draught, or bromide of potassium and camphor mixture, to allay pain and irritation; and to see that the tube is kept clear by occasionally passing a small gum-elastic catheter through it, or by injecting a little tepid water with a syringe, avoiding forcible injection. The diet for the first few days should be rather low, and the patient should drink freely of thin barley-water or other diluents, to increase and dilute the secretion of urine; the more he wets the better. After forty-eight hours in the adult, or twenty-four to thirty hours in children, the tube should be removed, as the track of the incision is by that time covered with plastic effusion, and the urine flows over it without risk. The wound gradually contracts and heals, although at first the action of the urine gives it a dirty

sloughy appearance. From the eighth to the tenth day some urine begins to pass by the urethra. It not unfrequently happens that shortly after the tube has been removed the urine passes by the urethra in full stream. This, however, is only temporary, and is due to swelling of the prostate closing the incision through its substance on withdrawal of the tube, and as the swelling subsides the urine again passes by the wound. In some cases retention supervenes and may lead to danger. In one case, of a young man on whom I had operated, I removed the tube at the usual time. About twenty-four hours afterwards, when making my visit, I was summoned to see him as hæmorrhage had occurred. As there had been no bleeding of consequence during the operation, I was rather surprised, but on going to him I found that there was smart florid bleeding. He stated that he had been trying to pass water, and on examination I found the bladder distended and the penis semi-erect. I passed a large gum catheter by the wound, expecting to find the bladder distended by blood, but it was full of clear urine, and so soon as the bladder was relieved all bleeding ceased and never recurred. The swelling in the deep part of the wound had caused retention, and the irritation and straining had caused engorgement of the organs and bleeding from congested vessels in the wound. It is not unusual, when the urine begins to pass again by its natural channel, to find the patient complain of a slight rigor or shivering; but this is merely due to sympathetic irritation, as the rigor that often follows the introduction of a bougie, and unless there be a repetition of the rigor or marked increase in the rapidity of the pulse, the symptom need not cause alarm.

If the incision has been carried too far laterally or upwards, infiltration of urine into the cellular tissue around the neck of the bladder may occur. The symptoms may supervene from twenty-four to forty-eight hours after the operation. The skin becomes hot and dry, the tongue furred, and the pulse quick. Gradually the patient becomes very restless, complains of a sense of fulness or pain in the hypogastrium, and there is some degree of tympanitic distension. The pulse becomes weak and irritable, and gradually begins to intermit, the intermissions becoming more frequent as the diseased action proceeds; the patient has a sunken anxious expression, fumbles with the bed-clothes, there is frequent hiccough, and incoherency or muttering delirium, and he at last sinks and dies comatose. On examination after death in such cases the track of the wound is found discoloured and disorganised, and the fine loose cellular tissue around the neck of the bladder, and in relation to the reflection of the peritoneum, is found sloughy and infiltrated with unhealthy purulent matter. This condition, however, must be very rare. I have never yet seen these appearances in the autopsy of any lithotomy case, and Sir William Fergusson, in his lectures before the Royal College of Surgeons of England, states that he has never seen it, and seems to think that the risk of infiltration has been much exaggerated. I should, however, be rather inclined to say that the attention which has been directed to this source of danger, and the care taken as to the direction and limitation of the prostatic incision in modern lithotomy, have in a great measure obviated it.

Should this condition arise, I fear we can do very little to remedy it beyond giving stimulants and trying to support the patient's strength. Sir Benjamin Brodie mentions a case in which, by laying the track of the wound and the cavity of the rectum into one, allowing the escape of the sloughing tissue, he saved the patient, but I am not aware that the treatment has ever been repeated by any other surgeon.

A limited form of infiltration or foul urinary abscess may occur from imperfect division of the anterior fibres of the levator ani or other tissues, if these prevent the free flow of urine by the wound. The use of the tube, however, tends to prevent such lodgment, by maintaining a free outlet for the urine until the loose textures are consolidated by plastic lymph. For this reason, and also because it may be useful in enabling us to plug the wound in the case of venous bleeding, I consider its use advisable, and if it seems to produce irritation it can be easily removed.

Suppression of urine occasionally, though rarely, follows lithotomy, as it does other operations on the urinary organs. I have met with only one instance of it in my own practice, in the case of an old stout man. There was no loss of blood during, nor any irritation after, the operation, but from the first four hours after the operation he passed no urine, nor did he feel any uneasiness. The day after the operation his pulse was seventy-two, regular, and of fair strength. He had no anxious expression, and felt no pain on pressure over the bladder, and when I visited the ward he was lying reading a newspaper. Everything seemed so favourable, that beyond introducing a gum catheter through the tube to satisfy myself that there was no water in the bladder and then injecting a little tepid water, I did not think it necessary to interfere beyond directing a sinapism and hot fomentations over the lumbar and hypogastric regions. Next day his pulse was irregular; still he was quite collected, and said he felt no pain, but he gradually became comatose, and died about sixty hours after the operation. I obtained an examination of the body. There was no appearance of disease or irritation in the peritoneum or abdominal viscera, with the exception of an enormous amount of fat. The bladder was free from any trace of inflammation, the track of the wound healthy, and the direction and extent of the prostatic incision all right. Both kidneys were very much congested, as also the renal veins, but there was no appearance of any structural change or disease of the kidneys. Were I to meet with a similar case I should lose no time, however slight the general symptoms, in using the vapour bath and other means to induce free diaphoresis, as well as employing powerful counter-irritation over the lumbar region.

Inflammation of the neck of the bladder, attended by excessive pain at the point of the penis, nausea, rigors, and other symptoms occurring from six to eight days after the operation is mentioned by some surgeons. I have never seen a case of this affection. The treatment recommended is depletion by leeches applied over the hypogastrium, or to the verge of the anus, opiate enemata or suppositories to allay pain, and diluent drinks and antiphlogistic regimen.

The symptoms described as ushering in this inflammation of the

neck of the bladder, as well as their progress and usually unfavourable termination, have a strong resemblance to those of phlebotic pyæmia. That unfortunate complication arises in old or elderly men from irritation and inflammation of the large prostatic veins, branches of the inferior plexus, being necessarily implicated by the incision. The symptoms generally manifest themselves by a rigor, fever, quick pulse, and slight nausea about the eighth or tenth day. In one of my cases—a gentleman fifty-eight years of age—the symptoms did not supervene until the fourth week, when the wound was all but healed. The patient had gone on most favourably, and I had ceased to visit him except occasionally. On calling one day he complained of not feeling so well, and attributed it to having partaken rather largely of hare soup; but his pulse was quick, and he had some tenderness over the liver. As he had suffered from hepatitis in a warm climate, I was in hopes that the symptoms might pass off; but the next day he had two rigors, and had vomited several times. The small portion of the wound which remained open was dry. The pulse was 140, and the skin was hot, dry, and slightly jaundiced, and he died about a week from the accession of the bad symptoms. The wound had contracted, and there was no trace of irritation in the bladder; the prostatic veins were engorged and congested. There was no suppuration in their neighbourhood, but the liver was studded with numerous abscesses.

My experience from the results of my own practice, as well as my observation of the practice of other surgeons, leads me to believe that, apart from the operative procedure, the mortality in lithotomy is mainly due to causes not under our control. The size of the stone in relation to the width of the parts through which we must extract it, and a rigid unyielding condition of the prostate met with in some elderly and old men, in whom we also most generally find enlarged prostatic veins, seem to me the conditions which continue to diminish the favourable statistics of lithotomy. Of children and boys under twenty years of age I have lost only one patient, and in adults between twenty-one and forty only one; but out of forty patients between the ages of forty and eighty-two I have lost eight, and all these fatal cases occurred in patients between the ages of fifty-six and seventy-two. All of them were large fat men, and in all of them the prostate was rigid and the stone above the average size, with one exception, where it was of moderate size, and in none of the fatal cases was there any difficulty in the operation, except in the patient seventy-two years of age, where the stone was very large and the perineum unusually contracted from old disease of the hip-joint.

Of these patients one died from continued venous bleeding or oozing, which neither plugging nor other means served to arrest. The patient was an old man with a deep perineum, but the operation was very easily performed, and there was no bleeding during its performance, nor for some hours afterwards. The lint prevented any bleeding from the wound, but clots oozed through the tube. I was anxious to obtain an examination, as the patient had suffered formerly from severe attacks of hæmaturia, but leave was refused. One case, already mentioned, died of suppression of urine, and four cases died from phlebotic pyæmia. Five

of these patients were from sixty-five to seventy years of age, and one was fifty-six. One case, that of the old man seventy-two years of age, from whom I extracted a very large stone, went on favourably for some days, and then died apparently from exhaustion. In the eighth case the patient was seventy-eight; everything went on favourably for three weeks, the wound was healed, and he was about to be sent home, when he began to complain of weakness, and talked incoherently during sleep, and gradually sank without any marked urinary symptoms. The two remaining fatal cases were young patients,—the one a child of four years of age, the other a young man of twenty-two. The circumstances of both these were peculiar. The child had suffered from symptoms of stone almost from his birth; but, except that he was very irritable, and that the urine was phosphatic, he seemed in fair condition. I extracted two calculi with great ease, and felt no anxiety as to the result. Next day I found him restless, and he had vomited, as was supposed, from the chloroform; but he had also diarrhoea, the stools being of a dark-green colour. The urine had passed freely by the tube and wound. As he was very restless I withdrew the tube. Vomiting and purging of a green colour continued almost without intermission, and he died in thirty-six hours after the operation. That his evacuations were healthy prior to the operation I can testify, for owing to some neglect an enema had not been administered, and the fæces were evacuated when he was being brought under the influence of chloroform. I obtained the parts operated on, and they show that the direction and state of the wound are as perfect as could be desired (fig. 226). This is the only fatal case I have had in children, and I feel at a loss to account for it, as there was no disease of the kidneys or liver, but merely congestion and irritation of the mucous coat of the stomach.

The young man, although twenty-two years of age, might have passed for fourteen or fifteen; he was extremely emaciated, stunted in growth, and sallow, had suffered intense pain from stone in the bladder from infancy, but both he and his friends had refused to permit any operation until his sufferings became so excessive that he could endure them no longer. He had a quick irritable pulse, dull pain over the abdomen, particularly in the right iliac region, and tenderness on pressing the perineum. The case was evidently a most unfavourable one, but as his only chance of relief lay in the operation, I performed it after some preliminary treatment. There was no difficulty in its performance, as I extracted a large phosphatic calculus with ease. The day after the operation I found him in great spirits owing to the relief from his previous symptoms, and for about a week he went on so well that I began to hope for a favourable result. But he then began to complain of general uneasiness, thirst, and want of appetite, and gradually sank and died fifteen days after the operation, apparently from sheer exhaustion, without any rigors or other marked symptoms. On examination the kidneys were found diseased, the coats of the bladder thickened, the mucous coat presenting the appearances of chronic cystitis. The textures in the course of the wound were not altered, but on the right side there was a large chronic abscess occupying the iliac fossa and passing down into the true pelvis. All these

morbid conditions were traceable, I think, to the long-continued irritation caused by the stone.

In regard to the statistics of lithotomy, it has long been understood that the average of successful results is greatly determined by the proportion of young patients operated on. If the number of children be large, the results will be proportionately successful. This circumstance, I think, accounts in some measure for the variations of success which not only individual surgeons, but particular hospitals, may experience. In the earlier years of my practice a great many young patients came under my treatment, and for a long time I never lost a patient, but latterly young patients seem to have become scarce, for during the last nine years I have only operated on two young patients, one of seventeen, and another of two years of age.

If a hospital be situated in the vicinity of what I may term "a stone district," it will be most likely to receive a great many more children suffering from calculus than a hospital at a considerable distance, for parents are naturally unwilling to be parted from their children under such circumstances. Now that many surgeons in the country operate, comparatively few children with stone are brought to Edinburgh, except from the vicinity; whilst adults still resort to it, for the benefit of surgical aid, from Caithness and other districts where stone is of frequent occurrence.

As to the statistics of lithotomy in the future, I am also inclined to think that these will appear less favourable than formerly, because the cases now properly chosen for lithotomy and litholapaxy—namely, those in which the stone is of moderate size, the bladder not very irritable, and the other urinary organs generally healthy—are just the cases which were the most favourable for lithotomy. Hence the abstraction of such cases will diminish the average of successful results, and make lithotomy appear more fatal than it used to be.

I have had no experience of lithotomy in the female, and, as I have already stated, I consider lithotomy as in all respects preferable to lithotomy or dilatation; but in any case of large or hard calculus, where lithotomy is required, the operation is performed as follows:—The patient being under chloroform, and held in the ordinary position, a straight grooved staff or director is passed along the urethra into the bladder. The surgeon then passes a straight probe-pointed bistoury along the groove of the staff into the bladder, and cuts obliquely downwards and outwards, but merely to a very small extent, so as to divide the urethra, by dilatation with the finger sufficient space is gained to admit of the extraction of a large stone. Some advise that the incision should be carried upwards and outwards, but I think that is attended with greater risk to the termination of the pudic artery, and besides, it places the incision in the narrowest part of the outlet of the pelvis.

LECTURE CXI.

DISEASES OF THE URINARY ORGANS—Retention of Urine from a Calculus in the Urethra : from Injuries ; from Paralysis or Atony of the Bladder—Disease of the Prostate Gland—Catheterism in cases of Enlarged Prostate—Methods of relieving Retention when the Catheter cannot be passed.

IN to-day's Lecture I begin the consideration of those diseases of the urinary organs which, under certain conditions, present the common symptom of retention of urine.

RETENTION OF URINE may arise from various causes, mechanical and constitutional. In infants we occasionally meet with a more or less complete closure of the orifice of the urethra by a thin membrane. In cases where the membranous septum does not close the whole meatus, a small aperture is left, through which the urine passes, but with great difficulty. In cases of complete closure the absence of wetting soon attracts attention, and the remedy is obvious—viz. rupture of the thin septum with a probe. The cases in which the closure is incomplete are more likely to be overlooked, and therefore are likely to lead to greater danger. Another direct mechanical obstruction is sometimes met with in the shape of a calculus impacted in the urethra, which effectually prevents the flow of urine. This often occurs in adults as well as children, and the accompanying symptoms are severe in direct proportion to the size of the stone. In children the calculus is generally small, and—owing to the great contractile power of the bladder, and direction of the urethra—it is generally projected far forward by the force of the urine—whence it is only prevented from being completely ejected by the narrow orifice of that canal.

In treating such a case it is necessary, in order to remove the foreign body, to press it forwards towards the orifice of the urethra, and then if possible to expel it. If the orifice be too small to allow of this, it should be slit open, and the calculus then removed, after which the urine will flow freely. In the event of the textures being divided, it is necessary during the after-treatment to pass a catheter occasionally, so as to prevent the parts from contracting too much during the healing process.

In the case of an adult, owing to the direction and curvature of the urethra, a calculus generally becomes impacted at a more posterior portion of the urethral canal. I have often had occasion to cut down upon the spongy portion of the urethra in order to reach the stone

lodged in the sinus of the bulb. In one case of retention of urine I passed a gum-elastic catheter without much difficulty, and without feeling or expecting to find a stone, and drew off the urine; but I discovered that I could not withdraw the catheter. On examining the perincum I at once felt the cause; the catheter had, in its turn, become impacted between the upper wall of the urethra and two large calculi, contained in the dilated sinus of the bulb; and as these could be easily felt, I cut down upon and removed them, and left the catheter in the bladder for thirty-six hours.

Sir Astley Cooper and others have recommended us to extract calculi from the urethra by means of an instrument formed for the purpose with expanding prehensile blades. But it is difficult to open these blades when in the urethra, so as to grasp the stone, and even if we succeed in this, it is difficult to effect extraction; so that this mode cannot always be trusted to. The best plan is to press the calculus forwards to as near the meatus as possible, and then eject it, or, if too large, enlarge the orifice by incision. If it be placed farther back, then fix it in front of the bulb, and cut down upon and extract it.

In cases where the calculus occupies the prostatic sinus, I would be now inclined to push it back with the sound or catheter into the bladder, and then seize and crush it with the lithotrite.

Retention of urine may arise from injuries of the urethra or bladder, but these injuries and their treatment have been already discussed.

Another cause of retention of urine is PARALYSIS OF THE BLADDER. This arises from affections of the nervous centres. It may occur, like paralysis of other parts of the body, without any apparent immediate cause, or it may arise as a direct result from injuries of the spine. Cases of the latter class seldom do well, for the injury leads to changes in the mucous membrane of the bladder, which, in their turn, lead to decomposition of the urine contained in it, and this again to a low form of inflammation in the coats of the bladder, which often causes a fatal result.

Paralysis is the simplest case in which the introduction of a catheter is necessary, for if there has been no previous stricture the urethra continues in its normal condition, and there is no obstruction to the passage of the instrument. A large size of catheter should therefore be used, No. 10 or 12. It is possible, however, to create difficulties even in connection with such cases as these, unless attention be paid to the position of the parts. If the instrument be passed too far down, it is apt to get hitched on the sinus of the bulb, just in front of the anterior layer of the triangular ligament, and if it be pushed too far in the same direction, a false passage will be made through the spongy portion of the bulb. If, on the contrary, the turn be made too soon, the point of the instrument comes into contact with the pubes, on the anterior margin of the opening in the triangular ligament, and that constitutes another difficulty. The point should be directed rather towards the right side of the urethra, and bearing lightly on its upper wall, until it is pretty well back in the perineum, and then gradually depressed by means of one finger placed on the upper surface of the

end of the catheter. If any obstruction be met with, the catheter should be withdrawn a little, and then passed rather towards the opposite side. The curve of the catheter should not be too large. In introducing it, the more lightly it is held the better. It should be guided gently, and not forced in any degree. If these points be attended to, there will be no difficulty in introducing the catheter into a paralysed bladder.

Paralysis of the Bladder does not occur so often as is supposed. Many cases so called are simply instances of ATONY OF THE BLADDER, the result of over-distension of its muscular fibres, and not attended with actual loss of nervous power in the organ. In many such cases the enlarged outline of the bladder may be visibly traced on the abdomen, and in most, but not all, it may be audibly traced by means of percussion. The bladder may be irritable from other pre-existing causes, therefore we must not be misled by expecting to find that the degree of irritation will always be in direct proportion to the amount of distension.

When we pass the catheter in a case of an enlarged atonic or paralysed bladder, we are apt to be disappointed with the comparatively small stream which results. This is due to the want of contractile power in that organ, for it does not propel its contents, as a healthy bladder would do, and what little force the stream possesses is due more to the action of the abdominal muscles than to any other cause. Pressure over the distended viscus causes the urine to flow in full stream. Under the use of the catheter the atonic bladder gradually regains tone, and eventually contracts, and empties itself normally. In the slighter cases of retention the bladder should be stimulated to action by sinapisms over the spine and upper part of the sacral region, and heat should be applied to the lower part of the abdomen. The patient should be admonished to pass water frequently, so as to prevent large accumulations in the bladder, and then it will more readily regain its power.

Amongst the more common of the causes of retention of urine, DISEASES OF THE PROSTATE GLAND are of great importance, and the different conditions require careful attention. These are simple hypertrophy, chronic or acute prostatitis, or malignant disease. Acute prostatitis is met with occasionally in young people, and may be the result of exposure to cold, gonorrhœa, or the use of instruments. It is characterised by the ordinary symptoms of inflammation, one of which, the swelling, gives rise to an additional symptom—that of obstruction to the flow of urine. On examination by the rectum, the gland will be felt enlarged, and very tender to the touch.

What we have to deal with in this case, in the first instance, is the retention of urine, and you may well imagine that in such circumstances the passing of a catheter is attended with great pain, as well as danger, and this applies also to scrofulous disease of the prostate. If, therefore, any other means of relieving the bladder can be devised, they should be adopted. Opiate enemata and the warm bath should be

tried; if these fail, the patient should be put under chloroform, and the urine drawn off with the catheter. A medium-sized catheter, say No. 7 or 8, is likely to be attended with least risk. This, if skilfully managed, will effect the desired result. Afterwards leeches should be applied to the verge of the anus, an opiate suppository inserted, bromide of potassium with camphor mixture ordered, and hot fomentations applied continuously to the perineum and lower part of the abdomen, to allay irritation and inflammatory engorgement. Should suppuration occur, and the abscess be felt pointing towards the rectum, do not open it through the rectum, but cut down in the perineum. Very often the abscess bursts during the passage of a catheter, and a stream of pus escapes with the urine; but such a condition is to be avoided if possible, as the urine gets into the abscess cavity, considerable irritation results, and not unfrequently a chronic fistulous condition is established.

In elderly or old men, the prostate gradually becomes enlarged and rigid. This enlargement gives rise to an altered position of the prostatic portion of the urethra, and hence to a difficulty in emptying the bladder. In such cases the retention occurs mostly in fits, and continues for about a fortnight. During these periods of exacerbation, the patient requires to have his urine regularly drawn off. At other times during the intervals, the patient has more frequent calls to pass urine than formerly, and he is able to pass it without assistance—more slowly than usual, however, and generally without completely emptying the bladder.

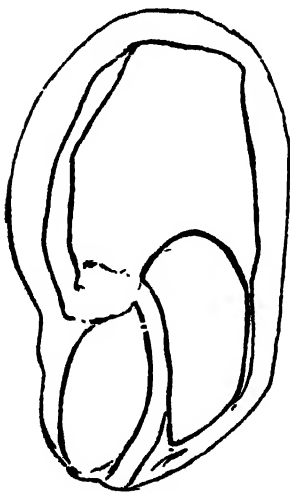


Fig. 227.

The periods of exacerbation occur generally in spring and autumn, the damp chilly seasons of the year. They are usually accompanied by irritation of the bladder, and the urine is often loaded with phosphates and urates, together with a secretion of ropy mucus. In patients of arthritic diathesis, the uric acid is often deposited in very large quantities, often alternating with the phosphates, and the affection frequently corresponds to an attack of gout.

In enlarged prostate the obstruction is not due entirely to the enlargement, but partly also to the altered position of the urethra, the axis of which is often curved and distorted by the irregular

swelling of the substance of the prostate which impinges upon it. The prostatic part of the urethra, which normally is little more than an inch long, becomes dilated, elongated, and its axis altered, owing to the en-

Fig. 227. Outline sketch of great general enlargement of the prostate gland, showing the altered relation of the bladder, which is pushed up above the pubes; also the alteration in the course and length of the prostatic urethra.

largement of the gland. The position of the bladder becomes altered, the superior fundus being elevated out of the pelvis, whilst the posterior part of the prostate itself is projected upwards within the bladder, the *bas-fond* or inferior fundus of which forms a sort of *cul-de-sac* behind the gland. Owing to this condition, the urine is passed slowly, and tends to dribble away after it has ceased to flow in a stream. In treating the irritable bladder in cases of enlarged prostate, it requires to be washed out from time to time with a weak solution of carbolic acid in water (1 part of the acid to 100 of water), as the urine lodges in the pouch behind the gland, and becomes decomposed and ammoniacal. Deobstruents, as iodide of potash, may be administered, and the patient should be directed to guard against exposure, especially during the cold seasons.

In some cases the prostate gland may be enlarged on one side only, or one lateral lobe much more than the other. Or its body, formed by the two lateral lobes, may be very nearly of its normal bulk, that is, about the size of an ordinary chestnut, whilst its central and posterior part may be altered in size, form, and direction, constituting enlargement of the third lobe. A portion of the central part of the gland protrudes, so as to form a sort of valvular projection into the bladder over the orifice of the urethra, and, when inflammation or engorgement occurs, the urine is prevented from passing out. In some instances this projection of the third lobe is almost pedunculated in form, so that when the urine is pressed down by the contraction of the bladder, the projection is forced before it against the opening of the urethra, and closes it like a valve.

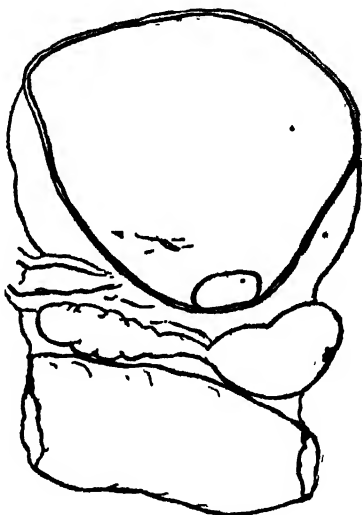


Fig. 228.

In other cases, again, the gland is not so much enlarged as very dense and elongated, with its thickest portion lying above the urethra. When this rare form of enlargement of the gland occurs it becomes very much elongated, and the prostatic urethra is stretched almost to a straight line upwards, at an acute angle to the membranous portion. As I have mentioned, a larger portion of the gland-substance lies on the pubic than on the sacral aspect of the urethral canal. If we examine such a prostate from the rectum, and at the same time have an instrument in the bladder, we feel no great enlargement of the gland.

Fig. 228. Sketch showing enlargement and projection of third lobe of the prostate. The size of the body of the gland is normal. The projecting lobe acts as valve, preventing free micturition.

On the contrary, we feel that the finger is nearer the instrument than usual, but we also feel that the gland-substance is elongated and stretches up beyond the reach of the finger.

Another and very different condition from any of the foregoing is sometimes met with, namely, enlargement of the gland, attended with peculiar symptoms. It may occur at any period of life, but is most common in people above middle age. The symptoms supervene rapidly. There is excessive and constant pain, frequent desire to make water, and much blood and *débris* are passed by the urethra. On examining by the rectum, the gland is felt enlarged, but soft. On introducing a catheter, in passing it through the prostatic part of the urethra, it seems to sink through a soft mass, and bleeding, occasionally very profuse, occurs after withdrawing the instrument. There is great local irritation, the constitution sympathises, and the patient becomes cachectic. These conditions are symptomatic of fungoid tumour, or malignant soft cancer of the prostate. We also more rarely meet

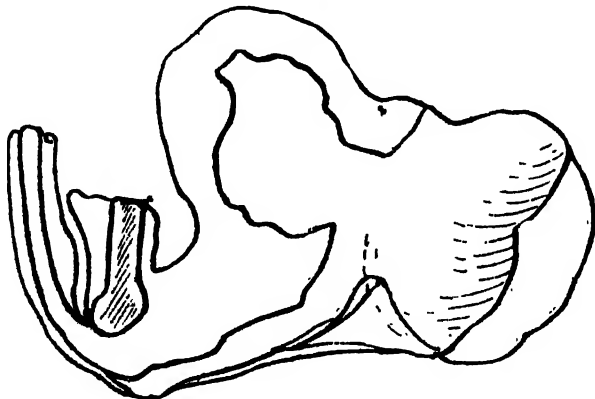


Fig. 229.

with carcinomatous disease of the prostate, attended in its later stages with most agonising symptoms.

In treating cases of prostatic disease, if we had merely to relieve the retention of urine their treatment would be attended with no great difficulty. But although in most cases of enlarged prostate we have the state of complete retention occurring after exacerbations caused by cold, errors of diet, and frequently coming on at certain seasons, as in spring and autumn, yet the patients generally suffer more or less continually from irritable bladder or chronic cystitis. The bladder, in some cases, is never thoroughly evacuated, and the urine is apt to become decomposed, and to keep up or increase the irritable or inflamed state of the organ. In treating such cases, therefore, we must attend

Fig. 229. Sketch of a very rare form of enlarged prostate, with great elongation and altered course of the prostatic urethra. The larger portion of the prostate is on the upper or pubic aspect of the canal of the urethra. When a catheter was introduced there was little thickness of the prostate to be felt from the rectum. The walls of the bladder are seen to be greatly hypertrophied, and a large cyst or pouch projects from its posterior and inferior aspect.

to the general state of the patient. The use of the hip-bath and warm fomentations over the abdomen are beneficial, and the urine must be frequently examined, as it should be in all cases of urinary disease.

If retention of urine be present when we are called to the patient, we must relieve that at once by the use of the catheter. We must not be thrown off our guard by the statement that an instrument has been used, and that there is no water in the bladder, as only some blood came away, for in that case we may safely conclude that the catheter has not been in the bladder, but has made a false passage through the urethra, or lodged in the dilated prostatic urethra. In some instances you may even get away a little water from this prostatic portion of the canal, which is often dilated into a small pouch containing the urine which overflows from the distended bladder, and this urine, flowing by the catheter, might mislead into the belief that the catheter had entered the bladder. We are often told that the patient is constantly micturating, so that there can be nothing in the bladder; but in all cases we should examine the abdomen by percussion and palpation, as that will show the true state of the bladder. We cannot feel the bladder from the rectum when the prostate is very much enlarged, because it is thrown up from the pelvis; but we can always feel it from the abdominal parietes. Where there is the least doubt we should pass the catheter, and satisfy ourselves as to the real state of matters.

In most cases of enlarged prostate an ordinary catheter will answer well enough. Before using the instrument the alteration in the relation of the parts should be noted, and the great liability to spasm should further be borne in mind. A full-sized round-pointed catheter will enter most easily, but it must be passed carefully and gently. On coming to the prostatic part of the urethra we depress the handle rather more than usual, so as to elevate the point of the catheter. If it be obstructed in the mesial line, direct the point to one or other side in case it be a lateral enlargement, but do not use force. An ordinary catheter, however, may not be able to reach the bladder when there is great enlargement of the prostate, and in these cases we should use the prostatic catheter, which is about thirteen inches in length, and which has a different curve from the ordinary catheter. The curve is much more abrupt, and the instrument is longer from the curve to the point than the ordinary catheter. Its size should generally be large, No. 10 or 11 of the catheter gauge.

In cases where there is any real difficulty from great enlargement of the gland, the prostatic catheter passes much more readily, and will reach the bladder when an ordinary one may fail to do so. There is no more risk in using it than the common catheter, if it be passed properly. We must recollect the greater length from the curve to the point, to keep it bearing gently against the upper wall of the urethra, as we pass it onwards, not letting it get too far down in the perineum, hooking it up under the pubis as it were, then depressing the handle, and using very little pressure to guide it onwards and upwards. In this way the instrument may in general be readily passed into the bladder.

¶ Another method of emptying the bladder in cases of enlarged pros-

tate, is to use a gum-elastic catheter with a stilette. We use it with an ordinary curve at first, and pass it down into the membranous, then into the prostatic part of the urethra, onwards to the obstruction. We then withdraw the point of the stilette. This increases the curve of the catheter, and tilts its point over the obstruction, and thus it sometimes enters the bladder, when a silver catheter will not pass so readily. When there is any real difficulty, however, though we may succeed occasionally with a gum-elastic catheter by the manœuvre above described, I think that the silver prostatic catheter is the safest and the best, as we can guide its course. I occasionally use the elastic catheter when, from previous experience in a case, I know that there is a valvular obstruction from projection of the third lobe of the prostate.

The vulcanised or soft bulbous-pointed india-rubber catheter is very useful for some purposes. In country practice, where we cannot always visit our patient frequently, the vulcanised india-rubber catheter is most suitable, as it can be left in the bladder with much greater safety than the gum-elastic or the silver instrument. Again, whilst it is not always safe to allow patients to use a catheter themselves in prostatic disease, yet with a vulcanised india-rubber catheter, from its softness, they can do themselves no harm even if they fail in getting the instrument into the bladder; care, however, must be taken not to allow it to slip into the bladder. It should never be used, however, when there is any laceration of the urethra. This very soft instrument must be introduced bit by bit, because, if we take too much of it in hand at once, it bends upon itself. It should have considerable resistance at the point, and the eye should be small, so as to obviate the bending of the point on itself near the eye.

Besides the mere mechanical treatment in prostatic disease, I have already said that we must also attend to other things. Having relieved the urgent condition of retention, we then direct the patient to take some strong decoction of *Parera brava*, or the infusion of *Triticum repens*, to allay irritation of the bladder and urethra. If the urine be loaded with mucus, the infusions of buchu or uva-ursa should be given, either alone or with the pareira. We must also examine the urine to see whether it is phosphatic, or if it merely contains phosphates from the prostatic irritation; and we must be careful to make this examination occasionally, at short intervals. The first urine drawn off after retention will probably be ammoniacal; but if it be generally acid, bromide of potassium in camphor mixture, either alone or in combination with small doses of iodide of potassium, may be given with advantage. The tendency in prostatic disease, however, is for the urine to become alkaline, and therefore we should be very cautious in giving alkalies too freely. We often require to give some nitric or nitro-muriatic acid to relieve the irritable state of the bladder caused by the presence of phosphatic or ammoniacal urine. In the earlier stages, and when no uræmic symptoms are present, opium or belladonna, in the form of suppository, will sometimes relieve the pain and irritation, and the use of leeches to the verge of the anus, with warm fomentations to the perineum, and sinapisms over the loins or sacrum, will occasionally relieve the congestion of the prostate. Iodide and bromide of potassium have been much used,

and lauded as not merely relieving symptoms but as diminishing the enlargement of the prostate, but I cannot say I have ever seen much benefit from their use, except in allaying the irritation of the parts.

I have alluded to the necessity for washing out the bladder in cases in which that organ does not fully evacuate its contents, and where, in consequence, the urine becomes decomposed and ammoniacal, with a view to prevent the irritation caused by the stale urine. Washing out and injecting the bladder with certain solutions is also indicated for the cure or alleviation of chronic cystitis, or irritable bladders attended with purulent or muco-purulent deposit in the urine, so frequent in prostatic disease. In such cases I can strongly recommend washing out the bladder with carbolised water (1 part to 100) until the fluid comes off clear, or nearly so, and then injecting a weak solution of borax with glycerine (4 grains of borax and 5 drops of glycerine to each ounce of water), and leaving some of this solution in the bladder. In cases where the urine is persistently alkaline, a little of the carbolised water should be left in the bladder instead of solution of borax, after having used a dilute nitric acid lotion, one or two drops to the ounce of distilled water. I generally use the ordinary catheter and small india-rubber bag, in preference to the double catheter, so that the fluid may somewhat distend the bladder, and so come in contact with its entire mucous surface.

In the later stages of prostatic disease, albuminuria with deficient excretion of urea may arise from organic disease of the kidneys. The complication is important, and should be borne in mind, as it exercises an important bearing upon our treatment. Glycosuria, also, occasionally occurs, and requires special treatment, both dietetic and medicinal, but as a rule the orthodox diet should not be too rigidly enforced, as the stomach is apt to be deranged and the health suffers. Sometimes, associated with the glycosuria, a deposit of uric acid occurs; such a complication is very troublesome, and the diet must be arranged according to the prominence of either symptom.

In the more advanced stages of prostatic disease, attended with constitutional disturbance, we must be very cautious in giving opium, for there is a tendency to uræmia, and the use of that drug is attended with danger, for the symptomatic coma of uræmia is very similar to that of opium-poisoning, and even a small opiate may determine an unfavourable issue, by increasing the tendency to coma. Henbane is preferable in such cases, when we require to use an anodyne. The means I have mentioned relieve the congestion and the irritable state of the bladder and kidneys, and then, in most cases, by the use of simple diluents, or of acid or alkaline drinks, according to the state of the urine, the general condition of the urinary organs is improved.

The diet should be nutrient, but not too stimulating. The best stimulants are the light Rhenish wines or claret, for they do not tend to irritate the bladder as most of the red wines do; they also prevent the urine from becoming alkaline, and are slightly astringent.

If there be any malignant disease of the prostate, or if, in any case, there be much discharge of blood from the bladder, gallic acid, in 5-grain doses every three or four hours, may be given with very great

advantage. As a prophylactic in some cases of prostatic disease in gouty patients, I have found beneficial effects from the use of colchicum wine in small doses of eight or ten drops, either alone or along with bromide of potassium, taken at bed-time for a week or so, about the time when the exacerbation of the disease generally shows itself, or when there are any uneasy symptoms, as it will often ward off the attack. Indeed, I have known cases of patients in whom fits of retention were completely prevented by this remedy.

In cases of malignant disease we can do nothing but try to palliate the sufferings of the patient by means of opiates. Avoid irritation by too frequent use of the catheter, and arrest hæmorrhage, should it arise, by means of gallic acid or ergotin.

In cases of retention from enlarged prostate, when we are foiled in passing the catheter, how are we to draw off the urine? In such cases it has been proposed to puncture the bladder from the rectum; but in any diseased prostate, where the enlargement is so great that puncture would be warrantable, we cannot do it from the rectum, because the bladder is raised out of the pelvis by the enlargement of the gland, and we are unable to feel or reach the part of the bladder above the prostate, where it is uncovered by the peritoneum. Hence, if puncture of the bladder is to be adopted, it must be performed in the linea alba, immediately above the pubes. In cases of enlarged prostate the bladder is not so likely to subside behind the pubes as in the high operation for stone, because it is kept in its elevated position by that condition of parts; and here, therefore, we may introduce a trocar and canula with comparative safety, and then pass a large gum catheter through the canula, and leave it in the bladder. The opening so made may always continue pervious, as I have known in one case, where the patient made water through the anterior abdominal parietes, and lived in comfort for many years. In such cases a continuous mucous surface forms from the bladder towards the skin in this locality. The operation, however, is not a satisfactory one; it is attended with some danger, and there are few who would consider it comfortable to be compelled to micturate through the front of the abdomen. Besides, the operation is not necessary, for I think that with care and perseverance we should always succeed in passing a prostatic catheter, if not an ordinary one.

Sir Henry Thompson has recently advocated a modified puncture of the bladder above the pubes in those cases in which the patient has always to use the catheter to empty the bladder. By this means he proposes to avoid the irritation caused by frequent catheterism, and to render the patient more comfortable. The practice is by no means free from risk; the few cases which Sir Henry gives in illustration are not encouraging.

If, however, the natural passage be completely closed in, or distorted so that we cannot introduce an instrument, the preferable method in my opinion is to make a false passage through the prostate. A new and more direct canal is thus formed, and great benefit experienced. By passing a catheter, and guiding it carefully into the first portion of the prostatic part of the urethra, then, by attention to the axis of the pelvis, making it pass into the bladder by forcing it through

the substance of the prostate, and keeping it in for forty-eight hours, a new canal will be opened in a much more direct line—the urine will continue to pass through it, and the canal will remain permanently open. This method should only be adopted when we cannot pass a catheter through the ordinary passage. It is safer and more satisfactory in its results, however, than puncturing the bladder above the pubes, and is much more likely to relieve the retention permanently; and I believe it to be even safer than continued efforts to find the natural canal, when there has been much rough treatment with the catheter.

LECTURE CXII.

RETENTION OF URINE FROM STRICTURE OF THE URETHRA—Spasmodic or Congested Stricture: Treatment—Organic Stricture—Anatomy of the male Urethra—Pathology of Urethral Stricture—Morbid Changes in other parts of the Genito-urinary Organs arising from Stricture—Fistula in Perineo.

PERHAPS the most frequent and dangerous cause of retention of urine is contraction of the canal of the urethra, leading to obstruction, and constituting STRICTURE OF THE URETHRA. The urethra may be contracted either temporarily from some irritation leading to spasm and engorgement, or from true organic stricture, resulting from inflammatory affections, such as gonorrhœa, leading to consolidation and contraction in the parts. To the former of these kinds of constriction—the functional, spasmodic, or engorged stricture—the term stricture should scarcely be applied. It is a mere temporary contraction, for there exists no real stricture. It arises in most cases from some irritation or inflammation about the neck of the bladder, as in gonorrhœa, when the prostatic part of the urethra becomes irritable and the patient is constantly passing water over it, or from exposure to cold, or after some debauch. The bladder becomes distended, and the patient cannot pass water at all—the penis is semi-erect—the spongy part of the urethra is engorged, and there is a feeling of contraction and irritation, and intense pain and spasm about the rectum and neck of the bladder, with spasmodic attempts to make water—the patient striving in agony to pass a few drops of urine. In such cases the patient may suffer to such an extent from the retention that we may require at once to use a catheter to relieve him; we must, however, be very cautious in using it, and employ means to allay the pain and irritation when passing it.

In a very large majority of cases, however, the symptoms of retention are not so urgent. The pain and the desire to pass water are very marked, but the real distension of the bladder is not great. In such cases, where we have to deal with inflamed and congested and irritable parts as causing the obstruction, the introduction of an instrument really keeps up the irritation. We should therefore, if possible, avoid using a catheter, and rather put the patient in a warm bath and give an opiate enema. When the patient is in the bath pour cold iced water on the penis, and the spasm will often pass off, and the urine come away without the necessity of passing a catheter. Then, by attention to the general health, giving bromide of potassium and diluents, and by

putting the patient on antiphlogistic regimen, the tendency to the retention is overcome. These means should always be used first, for even if the retention still continues, and the use of a catheter becomes necessary, they render the introduction of the instrument easier. When these means fail to relieve the patient, and we require to use the catheter, we should give the patient chloroform, and apply cold or iced water to allay the irritability of the penis, which is engorged, congested, and consequently semi-erect, thus rendering catheterism difficult. In such cases there is not merely spasm, but also engorgement of the textures, and the catheter is very liable to cause bleeding, for the swollen mucous membrane is very apt to be lacerated, and the slightest abrasion in this state causes profuse bleeding from the urethra. We then take a No. 7 catheter, dip it in warm water, oil it well, and pass it carefully along the urethra as far as the bulb. If we meet with any obstruction we should withdraw the point a little, draw the penis forward upon the instrument very gently, and it will then pass in; but the condition of the prostate and neck of the distended bladder will cause some obstruction at the vesical entrance, for the parts there are very much swollen, the neck of the bladder is elongated, the axis of the membranous portion of the urethra is consequently altered, and we therefore require to depress the handle of the instrument more than is customary to make the point enter the bladder. After once relieving this organ, we must try to avoid using the catheter again, as every introduction of it excites fresh irritation. We should wash out the bladder with a weak tepid solution of borax or carbolic acid, and then insert an opiate suppository, and give bromide or acetate of potash, or aerated potash water, or camphor mixture, and apply warm fomentations or poultices above the pubes. When there is much engorgement we may apply leeches to the verge of the anus, to relieve vascular congestion, and this is attended with marked benefit in relieving the local irritation. The regimen should be strictly antiphlogistic.

True ORGANIC STRICTURE of the urethra is one of the most important of surgical diseases, and one which, perhaps more than any other, requires skill, experience, and tact in regard to diagnosis and treatment. This morbid condition may be defined as a diminution of the calibre of a portion of the canal of the urethra, due to the deposition and organisation of inflammatory products, either into the textures surrounding the mucous canal or on its free surface, leading to permanent and even progressive contraction, attended with more or less obstruction to the passage of urine.

To give distinctness to our views as to the usual sites of organic stricture and other important points in relation to its diagnosis and treatment, I must advert very briefly to the anatomical divisions of the urethral canal. If we trace this canal as it emerges from the bladder, we find it passing through the substance of the prostate gland, from above, downwards and forwards. This part of the urethra is wide, and closely connected with the substance of the prostate. Its floor presents foramina in which are openings of the prostatic ducts, and in the centre we have a raised line, terminating anteriorly in the verumontanum, in which the common ejaculatory ducts of the vesiculæ

seminales and vasa deferentia open; so that the mucous membrane is pretty firmly attached to the adjacent prostate. This prostatic portion of the canal is about 1 inch and 2 lines in length. The membranous portion of the urethra is the shortest portion of the canal, and traverses the interval between the two layers of the triangular ligament in a somewhat oblique direction from behind forwards, and from above downwards. If we measure this portion, where it lies between the layers of the triangular ligament, its length is 6 lines, or if we regard it as extending from the apex of the prostate to the bulb of the urethra, its length is $7\frac{1}{2}$ or 8 lines. The portion lying between the layers is wide, dilatable, and only loosely connected with the vascular and muscular tissues which surround it. Where it traverses the opening in the ligament it is closely attached to that resistant structure, is narrowed in passing through the opening, and receives an expansion of the fascia which is continued over the bulb, and gradually lost upon the spongy portion. When the urethra emerges from the opening in the triangular ligament, it comes in contact, and becomes intimately connected throughout its course, with a peculiar vascular erectile tissue, which, commencing in a pendulous or bulbous form near the urethral opening in the triangular ligament, terminates by forming the glans penis. This spongy portion of the urethra, as it is termed, is by far the longest part of the canal, its usual length being $6\frac{1}{2}$ inches, but it varies not only in different subjects, but according to the state of the penis, as will be seen by reference to the results of my measurements of the urethra. The mucous canal, corresponding to the spongy texture, presents some points worthy of our notice in reference to their surgical bearings. At the part where it corresponds to the bulb its lower wall or floor dilates into a sinus, which lies farther back in the perineum than the urethral opening in the triangular ligament, and hence an instrument has a tendency to pass into this sinus of the bulb, and in such a case, when the handle is depressed the point hitches in the sinus below the margin of the opening. Into this sinus also the ducts of Cowper's glands open, a fact which we require to keep in mind in reference to some forms of perineal fistula. Along the whole mucous surface of the urethra are numerous small lacunae. Near the orifice the mucous surface presents a very large lacuna, which sometimes gets the blame of entangling the point of the catheter. Where the urethra opens in the glans penis it is contracted and compressed laterally. The calibre of the canal at the orifice is even smaller than where it passes through the triangular ligament, so that it may serve as a gauge for the size of instrument which should pass easily along the rest of the canal, unless there be some abnormal cause of obstruction. To ascertain the exact measurements in length of the different portions of the canal, I adopted the following plan—as combining the advantage of anatomical precision, while at the same time the relation of parts is maintained exactly as during life. The prepuce being well drawn forwards over the glans penis, two handle needles were thrust through it near its orifice, and behind the needles a strong waxed ligature was firmly tied, so as completely to constrict the prepuce in front of the glans penis. The bladder and urethra were then mode-

rately distended with alcohol, injected slowly by the ureter, and placed in a covered vessel filled with alcohol. After the textures have by this means been hardened, a careful section of the bladder and urethra can be made, without disturbing the natural relations or curvature of the canal, and thus not only may correct measurements of the whole length be obtained, but the definite length of the spongy, membranous, and prostatic portions, their relations to each other and to surrounding parts, together with their depth from the surface of the perineum, can be accurately determined. I have made many such sections, and have taken casts from them. In very fresh, firm subjects, the section, as far as regards the urethra, can be well enough made without hardening with alcohol. We may here subjoin the results of the measurements so taken. These were taken by means of a piece of thin waxed cord laid along the canal, and following its curve.

I. Measurements of urethra ; parts in natural condition, penis resting on right groin.

Total length of urethra from meatus urinarius externus to anterior border of uvula vesicae, 7 inches $11\frac{1}{2}$ lines, or almost 8 inches.

Spongy portion.—From meatus externus to commencement of membranous portion at its entrance into the anterior layer of triangular ligament 6 inches 4 lines.

Membranous portion.—From its entrance at the anterior to its exit at the posterior layer of the triangular ligament, half an inch, or 0 „ 6 „

Prostatic portion 1 „ $1\frac{1}{2}$ „

Total length . . . 7 „ $11\frac{1}{2}$ „

Measurement of the walls of the membranous portion between the layers of triangular ligament { Upper wall . . . 5 lines.
Lower wall, $\frac{3}{8}$ inch, or . . . $4\frac{1}{2}$ „

II. Measurements of urethra ; penis previously injected with wax, so as to represent the erect condition.

Total length of urethra, from meatus externus to anterior border of uvula vesicae, $9\frac{1}{2}$ inches.

Spongy portion to orifice at anterior layer of triangular ligament, $7\frac{7}{8}$ ins.

Membranous portion $\frac{4}{8}$ „

Prostatic portion $1\frac{1}{8}$ „

Total . . . $9\frac{1}{2}$ „

The exact measurements of the width of the urethra are very difficult to obtain ; our results can be but approximative. The best plan is the old one, of taking casts by filling the bladder and urethra with wax or fusible metal, and so obtaining the width of the canal at different points when dilated by a moderate and equal fluid pressure.

Finally, as regards these anatomical hints, I would merely remind you that besides voluntary muscles related to the urethra at different

parts of its course, modern investigations have shown that the mucous membrane is closely connected by its submucous tissue with involuntary muscular fibre in every part of its course, not existing, however, in equal quantity throughout, and at some points interlacing with portions of the yellow elastic tissue.

In regard to the general course of the urethra,—if we look at the canal when the penis is pendulous, we see it has a double curve like the letter S, but the anterior curve is effaced when we stretch the organ, as in introducing a catheter, and then there only remains a very gentle curve from the bulb backwards and upwards through the membranous and prostatic portions of the canal to the bladder; but the direction of this curvature is liable to change, in consequence of alteration in the size of the prostate, or from dragging and elongation of the parts consequent on great distension of the bladder.

If we now examine pathological specimens of cases of stricture of the urethra, we find that two portions of the canal are almost exempt from this alteration. I have never seen, and do not know of, a single specimen of stricture situated in the prostatic portion of the canal, and strictures of the membranous portion are very rare indeed, except as the result of wound or injury. I have not as yet, in any collection I have examined, been able to find a specimen of organic stricture in that part of the membranous portion which lies free between the layers of the triangular ligament. Practically, therefore, we may say that strictures are almost limited to the spongy portion of the urethra, and perhaps the point of junction between it and the membranous portion at the opening in the anterior layer of the triangular ligament. If we examine the parts of the spongy portion of the urethra where strictures are usually situated, we find that by far the most frequent site of stricture is in what may be termed the bulbous portion, extending for about an inch in front of the bulb back to the opening in the ligament, the most frequent site being about half an inch in front of the pendulous bulb. The next most common site of stricture is from an inch to two inches from the orifice of the urethra; whilst the third, almost as common as the last-mentioned site, is immediately in front of the scrotum, nearly corresponding to the flexure of the penis when pendulous. The statement, frequently met with in surgical works, that the most usual site is in the membranous portion of the canal, is the result of an indefinite idea of its position derived from passing an instrument in the living subject.

The pathological condition, as already defined, consists essentially in the deposit and organisation of new material, causing contraction or obstruction of the canal. The morbid condition, however, is so modified by the position and extent of the deposit, and consequent alteration in structure, as to give rise to the different forms of stricture. These may be classified under two heads—*1st.* Contractions of the canal of the urethra caused by plastic deposit external to the mucous membrane, into the submucous tissue, or involving the other textures, and causing consolidation of the spongy erectile structure to a greater or less extent; *2d.* Contractions or obstruction of the canal due to the deposit and organisation of plastic material on the free or internal surface of the

mucous membrane, whether in the form of lateral folds of false membrane, thread-like bands of lymph, or false membrane stretching between the surfaces, or projecting wart-like masses.

Strictures arising from organised plastic deposit on the submucous aspect of the canal are by far the most frequent. The plastic lymph causing the contraction may be very limited in breadth, but may be deposited so as to include the whole circumference of the canal at the affected point; and as it becomes consolidated and organised, it forms a firm circle round the exterior of the mucous canal, constituting what is termed the annular stricture. This form of contraction may occur at any part of the passage, but is most frequently met with in strictures situated in the anterior regions of the urethra, and especially in those about two inches from the orifice. In such circumstances we can feel a little hard mass from the exterior; and when a solid instrument is passed fairly through such a contraction and along the urethra beyond, the narrow ring of consolidation is very distinctly defined, and can be felt by the finger. On examining the constricted point in a morbid specimen of this nature, we find the submucous tissue, and also frequently the spongy texture, consolidated and altered by the new material. On trying to raise the mucous membrane by dissection, we find it firmly adherent at the constricted point, and under it a somewhat flattened band of white fibrous tissue, which is usually very elastic and resilient. In other instances, as in strictures near the bulb, the new deposit generally involves a greater extent of the textures external to the canal, and is often thrown out irregularly, so as to impinge upon the canal laterally and distort the passage. The consolidation of texture arising from the plastic exudation may extend for some lines in length, and is usually more solid and resistant, and less resilient than the annular form. In many cases the consolidation and contraction are pretty equally distributed around the canal, merely narrowing its circle; but in others they take place so irregularly as not only to alter the direction of the canal but to cause its mucous surface to project irregularly, and thus render the passage of instruments very difficult. In old-standing contractions of this kind, the consolidated structure is very firm and unyielding, and when divided with the knife it cuts with the crisp sensation of the section of cartilage; and such old contractions are often spoken of as cartilaginous stricture.

The forms of stricture included under the second head, viz.—Obstructions of the canal from new formations arising from plastic deposits on its free surface are much less frequently met with. The old surgeons used to speak of stricture as always arising from the presence of caruncles or warty projections on the interior of the urethra. Very probably they supposed that the obstruction was caused by warty excrescences, such as they would often see arising from the mucous lining of the prepuce in cases of gonorrhœa, which is so frequent a cause of stricture, and they might infer that a similar state of matters existed in the interior of the canal. In reality, projections from the free surface of the urethra, whether in the smooth polypoid, or warty forms, are very rarely met with; less frequently perhaps than in any other

mucous canal. Projecting folds of false membrane, of a crescentic form, stretching along and attached to the sides of the canal, are sometimes met with. The false membrane, closely resembling the mucous lining, is usually attached by its convexity, and stretches from the floor of the urethra along the side of the canal, the concavity of the fold looking towards the orifice of the urethra, and not unlike a very large lateral lacuna. This form was spoken of by Sir Charles Bell as one kind of bridle-stricture, but I think the term valvular, expresses its appearance better. The true bridle-stricture is of very rare occurrence, and consists of a thread-like band of organised lymph or false membrane, stretching across the course of the canal from one point of its circumference to another, attached at each extremity, but free in the middle of its course.

The term resilient or elastic stricture is used to express a condition which may be present in any of the forms of stricture arising from alteration in the submucous tissues—those included under the first head. It is recognised chiefly by its vital characters. When an instrument is fairly passed through the contraction it dilates or yields so as to allow a rapid increase in the size of the instruments passed. Thus, in some cases where a No. 3 at first is passed with difficulty, when once it has been passed, 4, 5, and 6 may be passed in succession; but three or four days afterwards No. 3 is found to be grasped as tightly as at first. The new organised material presents a white fibrous texture, and is found to possess great elasticity and resiliency. I have said it may occur in any of the submucous forms of contraction, but the annular stricture is that in which this peculiar and troublesome condition is most generally met with.

Besides the pathological states of the urethra itself, we require to consider the morbid alterations of other organs which arise in connection with and in consequence of the urethral disease. Thus, even in its earlier stages, the testicle may become painful or swollen in consequence of the sympathetic irritation of the prostatic portion of the urethra; and in unhealthy patients subacute suppuration may even take place. In bad strictures of old standing the prostate gland frequently suffers. We often find it the seat of multilocular abscess. Its substance is sometimes entirely destroyed; and, its proper fibrous capsule thickened, forms the boundary of a cavity containing foetid pus, through which the canal of the urethra dissected bare passes, and with which it in general communicates by one or more ulcerated openings. In such cases the vesiculæ seminales are also often distended with glairy and foetid purulent matter.

But whilst the prostate is subject to this state of disorganisation, it is very rare to meet with enlarged prostate in combination with tight or irritable stricture; at least such is the result of my observation after a very large amount of experience in the treatment of bad stricture cases during the last thirty-five years, and after having examined many collections of morbid specimens. It might, perhaps, be possible to account for this; but, without theorising, I content myself with stating the fact that, though I have had occasion to treat very many bad strictures in old men, and whilst I have often met with the serious

alterations mentioned above, I have rarely found the prostate as much increased in bulk as it usually is after fifty years of age, and on two occasions only have I found chronic enlargement of the prostate so great as seriously to complicate catheterism in retention. In one of these, after passing a No. 3 catheter through the stricture, I found that, from the great enlargement of the prostate, and elongation of the prostatic portion of the canal, the small catheter could not reach the distended bladder. I forcibly dilated the stricture with an old-fashioned conical catheter, and then passed a No. 7 prostatic one into the bladder, and retained it there for thirty-six hours. In the other case the patient had laboured under stricture for nearly fifty years. He was seventy-six years of age, and the prostate was felt enormously enlarged; but he was labouring under complete retention, with abscess in the perineum. I opened the abscess, having first passed a small grooved stricture staff through the contraction, and then divided the stricture, and by using a large and long gum-elastic catheter I relieved the bladder. Both cases did well; but these, as I have said, are the only instances in which I have met with such a complication.

The membranous portion of the urethra, as it yields more readily than other parts of the canal, is always very much dilated in cases of tight stricture, and it is important to keep in mind this abnormal dilatation in reference to operations for relieving the bladder in certain cases of retention.

The bladder itself is always more or less affected in cases of stricture, and in bad cases very seriously. Owing to the obstruction it has to overcome in evacuating its contents, its muscular coat becomes excessively developed, the enlarged fasciculi of muscular fibres projecting the mucous coat and giving rise to the irregular appearance of its internal surface, termed the Fasciculated Bladder, a condition also met with in other morbid states, such as prostatic disease and chronic irritable bladder. This thickening or development of its muscular coat, if accompanied, as it generally is, by chronic irritation of the mucous membrane, leads to contraction of the cavity of the organ, so that its capacity for containing fluid is diminished. When the contraction of the urethra is very tight, and the bladder not so irritable, we sometimes find that the capacity of the organ is greatly increased, whilst at the same time the muscular coat is much developed.

In other instances the increased capacity for retaining urine takes another form. Pouch-like portions of the mucous membrane are protruded between the fasciculi of the muscular coat, forming cysts, some of which are occasionally found even of greater capacity than the bladder itself. In such cases a certain amount of water usually remains in the bladder, and occasionally the urine is discharged involuntarily, on certain positions being assumed.

In most cases of bad stricture, the ureters and kidneys are to some extent affected. In nearly all cases the ureters are somewhat dilated; but in certain instances the dilatation of the ureters is enormous, and in such cases the pelvis of the kidney and the infundibula are also distended, and the secreting portion of the gland compressed, so that the kidney presents the appearance of a cyst. This state, though in a less

degree than just described, is by no means uncommon in old stricture cases, though the urine secreted during life may have given little or no indication of organic change. Various other morbid conditions of the kidney are found in cases of stricture more or less directly connected with it,—granular disease, pyelitis, multiple abscesses in the cortical substance, and in some very bad old strictures I have found both kidneys much enlarged, softened, and broken up into granular and filamentous matter, as if they had been softened by maceration.

The irritation produced in contiguous textures by the presence of stricture not unfrequently leads to the formation of abscesses in the perineum, which, unless opened early, are liable to ulcerate into the urethra, behind the contracted part, and to burst externally; then, owing to the urine finding more easy vent through the adventitious opening than through the contracted urethra, a fistula in perineo results. When this condition occurs fresh abscesses form from time to time, and new fistulous openings through which the urine dribbles off. In many instances we find four or five such apertures, some opening on the scrotum, others in the perineum, and others towards the hips. There is great surrounding consolidation of the perineum, and when the patient makes water a small stream is ejected through each aperture, and very little passes through the urethra. On examination of such a case after death we almost invariably find that, however numerous and however distant the external apertures of the fistulæ may be, they all converge to a common fistulous canal, communicating with the urethra behind the stricture. In a preparation in my possession the fistulous tracks are lined by a smooth structure, resembling mucous membrane; and where no proper means have been used the contracted part of the urethra may have become absolutely impermeable from disuse.

LECTURE CXIII.

Symptoms of Urethral Stricture—Secondary effects on the Digestive Functions and on the Nervous Centres—Causes.—Positive Diagnosis of Organic Stricture—Treatment of Retention of Urine, arising from Tight Stricture—Curative Treatment by Vital Dilatation—Dupuytren's plan of Vital Dilatation.

A CONSIDERATION of the various morbid conditions which I have described will show you that in the diagnosis and treatment of stricture of the urethra we have generally to deal with more than the mere local alteration, and it should also impress you with the necessity for careful examination into the state of the different organs likely to be affected, as modifying the plan of local treatment which we may employ; and, besides the more direct complications, we have the indirect effect of the disease on the digestive organs and nervous system, which requires our most serious attention.

The causes of urethral stricture are various—injuries of the urethra and perineum; inflammation of the canal, however produced; abrasions by instruments, or ulceration from applications of caustics to the urethra. By far the most common cause, however, is the peculiar form of venereal inflammation, gonorrhœa, and the succeeding gleet. I should say that about 96 out of every 100 cases are due to gonorrhœa and its results.

The symptoms of urethral stricture, depending on the local condition, are gradual diminution of the stream of urine, till at last it comes only drop by drop, or ends in complete retention. The diminution in the size of the stream, however, is so very gradual, that the patient does not at first notice it, and insensibly gets accustomed to this state of matters, until his attention is attracted to it by some other circumstance, such as the length of time he requires to empty the bladder, and the straining which is necessary to effect the emission of the urine. Very commonly the thing that attracts his attention is, that after he has finished micturition and arranged his dress, he finds the urine dribbles away and stains his linen. At other times he notices the twisted or forked appearance of the stream. Not unfrequently irritability or swelling of the testicle causes him to consult the surgeon, and leads to the discovery of the real cause of his symptoms. The condition of complete retention is of course too urgent to escape notice, and this state may arise at a comparatively early period of the disease; because congestion, or irritation from any cause, when superadded to organic contraction, may occlude the passage temporarily; and in all cases of retention from organic stricture these causes are in operation.

The symptoms of disordered functions of the digestive organs, and hæmorrhoidal congestion arising indirectly from, or connected with, urethral stricture, are generally present in cases of tight contraction. Mr. Abornethy drew attention to this, and also to the fact that disordered functions of other organs, by exciting irritation of the urinary organs might simulate some of the symptoms of stricture. These views, though perfectly true when properly understood, led at one time to very mischievous practice. Unfortunate dyspeptics, who, under a series of leading questions, were made to confess that they occasionally felt uneasiness about the urinary organs, were at once subjected to a course of bougies, and they were fortunate if they escaped without having real mischief excited in the urinary passage. From what I have seen of patients who have been under treatment for stricture, I fear the most extended charity will not allow me to believe that the practice alluded to has been altogether abandoned. I have been frequently consulted by patients who had for weeks or months been undergoing gradual dilatation up to No. 3 or 4, but in whom I found that a No. 9 catheter passed without let or hindrance into the bladder. Indeed, in a recent brochure on urethral stricture, I find it stated that the easy introduction of No. 9 or 10, or even a larger sized bougie, is no test of the absence of stricture!! That not only two strictures, but six or seven may exist in the same urethra!!! And there is an ingeniously-constructed urethra-meter mentioned, which is well calculated to prove the existence of stricture in any urethra not capable of admitting a large filbert or a small walnut. Surely the morbid specimens in museums cannot be much studied when such statements pass current.

There is one indirect effect of bad stricture to which I would draw your attention, as of importance in regard to its diagnosis, prognosis, and treatment—I mean the secondary effect produced on the nervous centres of the lower part of the medulla spinalis, in consequence of the long-continued irritation of the nerves supplying the bladder and adjacent pelvic viscera, giving rise at first, by reflex action, to functional, but, unless checked, ultimately leading to organic, alteration in the medulla spinalis. The symptoms of this condition are very alarming, simulating as they do those of incipient paraplegia, and in some cases culminating eventually in that condition. Thus we have neuralgic pains in the lower extremity, and also in the lumbar region, cramps or spasmodic twitches of the lower limbs, especially when in bed, a feeling of dull weight and constriction over the lower part of the abdomen, and gradually increasing weakness of the lower limbs. It is of course quite possible that chronic disease of the medulla spinalis may occur coincidentally with stricture or vesical affection; but, in the cases I refer to, the symptoms are produced in the first instance reflexly, and depend, as I have said, on long-continued irritation of the branches of the lumbosacral plexus, and also of the organic nerves of the hypogastric region. The chronic congestion of the vessels of the pelvis and neighbouring parts will also conduce to give rise to this condition. When these symptoms, therefore, arise in cases of stricture, we are, I think, warranted in forming a favourable prognosis, as the morbid conditions with which they are connected are in the first instance merely func-

tional; and if the treatment of the local affection—the stricture—be successfully carried out, and means taken to allay the irritation of the urinary organs, and to relieve pelvic congestion, the alarming symptoms will disappear, and organic changes in the nervous centres will thus be prevented.

In regard to the positive diagnosis of urethral stricture, that can only be arrived at by instrumental examination when carefully and methodically conducted, for all the symptoms of stricture, whether constitutional or otherwise, depending on the local obstruction, may arise from other causes. In conducting an exploration with instruments I have said it must be carefully done, and on some fixed principle; for otherwise it is quite possible to be misled by such an examination. Thus, if taking for granted the statements of the patient, that he has a stricture, or, influenced by retention of urine being present, the surgeon at once begins by trying to pass a small catheter, he may not succeed readily, but if he at last manages to get a No. 1 or No. 2 into the bladder, he may conclude that he has had to deal with a tight stricture. In such circumstances the diagnosis is not certain; the operator has probably been making difficulties for himself, and it is not unlikely that if he had begun with a No. 7 or No. 8 catheter it would have passed with less difficulty. In all cases of a first diagnostic exploration the surgeon should use a medium-sized catheter. If there be no organic stricture there is less risk of injuring or irritating the mucous membrane, and the instrument will pass more readily than a small one. If there be an organic stricture, the point of arrestment will serve so far to indicate the site of the stricture. So far back as 1844 I devised a bougie with a probe point, about the size of an ordinary pocket-case probe, the stalk increasing very gently and gradually in diameter towards the handle. This instrument I have found of great use in passing through tight strictures, and in determining in some measure the site and extent of the contraction. But the instrument which I consider affords the surest diagnostic evidence is the probe-pointed steel stricture-staff, such as is used in perineal section. The small probe-pointed portion of the staff, which is similar to the bougie just mentioned, will pass more easily than any other instrument through a tight stricture—whilst the abrupt swell of the thick portion of the staff is of course arrested by the organic stricture, and defines exactly the anterior part of the contraction; whilst, if the case be not one of true stricture, whenever the probe point passes, the thick portion of the staff follows without difficulty, and can be felt from the rectum, so as to settle completely all doubts on the subject. We must, however, be careful to examine from the rectum, and ascertain that the thick part of the staff has passed into the membranous portion of the urethra up to the prostate; because, when the narrow part of the instrument passes a short stricture, and enters the bladder, the thick portion can be depressed by pushing the contraction before it; but then, by means of the finger in the rectum, we can feel that the narrow part of the staff only has passed, and that the thick portion is still arrested in the perineum. With these precautions, and using great gentleness in passing the instrument, I consider this method of

diagnosis affords us absolute certainty as to the existence and site of an organic stricture.

I now proceed to speak of the TREATMENT OF STRICTURE, and we must consider this under two aspects. *First*, the treatment when the emergency of retention of urine has occurred in consequence of organic stricture; *secondly*, the different methods employed for the radical cure of the disease, or the treatment of stricture properly so called.

There are few emergencies in surgery attended with more urgent symptoms, or requiring greater skill, experience, and determination, tempered with gentleness in manipulation, than retention of urine arising from tight organic stricture; and whilst I may be able to give you some hints for your guidance, founded on a considerable experience in such cases, I feel at the same time that this is one of those subjects where many important advantages of experience are not communicable, but must be attained by each one for himself.

To begin,—In dealing with cases of retention from organic stricture I would advise you to hold as an axiom that, wherever the patient has, up to the time of the attack, been able to pass water by the urethra, in however slender a stream, there must be a passage along which you should be able to pass an instrument into the bladder. In regard to absolutely impermeable contractions, I know that, pathologically speaking, they do exist. I have two specimens in my own collection, but they are excessively rare; and in regard to your practice in the case of retention, you will do well to dismiss the idea of impermeability from your mind, and adopt the axiom I have recommended. Like the word “impossible,” the term impermeable, in relation to stricture, is apt to lead to failure by preventing or weakening effort, and leading to a want of that determination and perseverance which are founded on a certainty of success if these efforts be properly directed.

I once heard an old surgeon, who had had great experience in treating stricture, and witnessing the treatment of others, say that he believed the success of some surgeons, in relieving retention where others had failed, depended on “patience, perseverance, and sweet oil”—a quaint way of expressing what I believe is very true. Without at all disparaging the last very useful item, “the sweet oil,” I would specially direct your attention to the combination of patience with perseverance.

It is not by mere dogged, determined perseverance, persisting in the use of instruments, that you will succeed. You must, under trying circumstances, patiently consider the probable causes of difficulty, keep your temper from getting ruffled, and never let it lead you into forcible or unmeaning manipulations, otherwise you will increase your difficulties by making false passages. The instrument must be managed gently, held lightly, and guided by the finger of the left hand introduced into the rectum. No force should be used. But then, you may very well ask, What do you mean by no force? Can you pass an instrument along the urethra, through a tight resistant contraction, without some degree of force? and how much, then, is justifiable? Well, I cannot answer the question by saying how many pounds weight of power

would be safe, and how much would do harm. So far as I can communicate my own sensations as to force, I say that, in using the catheter or other instrument in such cases, I hold its flat handle lightly between my finger and thumb, and merely communicate sufficient force to guide it along the canal. When I meet with an obstruction—if I feel the point of the instrument pushing against it—I use no force to propel it; on the contrary, I rather leave off all pressure, and, if the instrument feels loose, then I know it has not entered the contraction, but has been pressing against or hitched upon some fold of the mucous membrane, and that if I had persisted in pressing it on forcibly, I should have made a false passage. If, on the other hand, on withdrawing the guiding pressure, I feel that the instrument is held or grasped—it has entered the contraction, and if that be tight and of firm consistence, or of some lines in length, then a moderate and sustained degree of force is warranted and necessary to pass the instrument onwards to the bladder.

I would here advert to another point in reference to passing the catheter in tight strictures—namely, that when the instrument has fairly passed through the stricture, it is sometimes difficult to guide the point through the membranous and prostatic portions of the canal, from the firmness with which the body of the instrument is held in the stricture, and hence the need for the finger of the left hand being introduced into the rectum to guide the point of the catheter in its onward course.

In all your manipulations in these cases you must keep before you the natural direction and course of the urethra, in conjunction with the anatomy of the parts, both in their healthy and morbid states; but the tact in using instruments, and various manœuvres by which difficulties are sometimes overcome, can, I believe, only be learned by each one for himself, as the result of experience; and on such experience, and the resources which he has in himself, will depend the greater success of one man than another in the treatment of stricture. In different cases of tight unyielding stricture, the probe-pointed steel stricture-staff is often of service to make way for the silver catheter; which, when of small size, has not sufficient rigidity to enable us to direct it so readily through the contraction and onwards. My colleague, Dr. Watson, uses a probe-pointed steel catheter. I never myself found occasion to use it, but I can conceive it of service in some cases. In most cases, however, when there has been great difficulty in passing a small instrument in cases of retention, I think it advisable to leave in the catheter, and should prefer a silver to the steel instrument for that purpose, and I confess to a dread of the temper of a hollow steel instrument, so that I have in very difficult cases proceeded by passing a steel staff, and then followed it by the silver catheter, or else performed perineal section at the time, and emptied the bladder by a full-sized gum catheter, and left it in for some hours. The latter method is rendered imperative in some cases by the viscid or purulent state of the urine, which would soon block up a small silver catheter.

I have hitherto directed your attention principally to the method

of dealing with the mechanical obstacle caused by the contraction. I have done so because in cases of retention from organic stricture we cannot afford to lose time. We must, however, recollect that in all such cases congestion and spasm from irritation are also present, and we should therefore use means to allay them, so far as that can be done, without risking delay in passing instruments. An opiate enema may be administered, and cold or iced water applied to the penis and perineum to relieve congestion, and chloroform may be used before resorting to instruments. But none of these measures are to be trusted to by themselves, because the difference between this and spasmodic stricture is, that here the spasm and irritation are due to and kept up by the organic disease, and will not yield until the catheter has been passed. A warm bath often relieves the uneasiness of the patient, and he sometimes passes a little urine whilst in the bath; but I repeat that no time should be put off in trying such measures when retention is urgent.

In dealing with old tight strictures, when retention is not present, and where there is therefore no absolute necessity for at once passing an instrument, we should take measures to allay irritation, and prepare the patient for strictly surgical treatment by attending to the state of the bowels, the character of the urine, and other general conditions, as well as by using the hip-bath and anodyne suppositories to allay local irritation. In some patients, who suffer from aguish symptoms, the use of quinine, or infusion of cinchona, is generally of great benefit. In trying to pass instruments in such cases, whilst it is always advisable to get an instrument passed through the contraction, it is unwise to persevere too much; there is not the necessity as in retention, and our manipulations may do harm. Still, as I have said, it is important, if possible, to pass an instrument, however small, fairly through the stricture into the bladder, for this is always attended with relief of irritation, whereas unsuccessful attempts generally increase the irritability of the urethra and bladder.

In such old tight strictures one cause of difficulty and embarrassment is the existence of numerous old false passages, some of them, perhaps, nearly parallel to the natural passage, and of considerable length, and as their walls are consolidated, the sensation in passing the instrument is very similar to that of passing through a stricture, whilst there is no bleeding, as when a new false passage is made in catheterism. In most instances, by gentle and careful use of the probe-pointed bougie or stricture-staff, we will succeed in getting it into and through the contraction; but I have occasionally succeeded in some cases of very tight strictures, complicated with false passages, by a simple and ingenious method long practised on the Continent. It consists in passing a number of filiform probe-pointed bougies. Say that there exist three false passages.—The surgeon takes one of these instruments and tries to pass it through the stricture, but feels that it has found its way into a false passage, and leaves it there; he then tries another, and leaves it in like manner in another false route; and so with the third. He now takes another of the bougies, and as all the three false passages are pre-occupied, this, if passed gently, almost infallibly passes into and through the stricture. The whalebone probes are so fine that

they will pass through a contraction which will admit a bristle, and their delicacy prevents undue force being used. I have never tried this plan in retention cases, because the congested state of the parts seems to me to be unsuitable for it, and besides, we require to pass an instrument of sufficient size to evacuate the bladder. Dr. Gouley, of New York, has ingeniously adapted this method as a means of conducting a metallic catheter grooved on its convexity down to the stricture, so as to enable him to divide it by perineal section in cases of very tight strictures; but the fine probe-pointed grooved staff, passed fairly through the contraction, is a much surer guide for the knife.

The *Curative Treatment* of organic stricture is conducted by different methods and on different principles, but all have for their ultimate object the more or less rapid and complete removal of the conditions causing the contraction or obstruction. It would be alike difficult and useless to try to enumerate all the plans proposed for the treatment of urethral stricture. I shall confine my remarks to the methods now practised. These may be classified under the heads of—Vital Dilatation; Destruction of the Contraction by Caustics; Division of the Stricture by lancette-catheters from within the canal or by Perineal section from without; and by Forcible Dilatation or rupture of the contraction, as by Holt's Method. Some of these plans of treatment I can do little more than mention. The methods which, from extensive experience in stricture cases, I consider really safe and effective, are—Vital Dilatation, Holt's Method, and Perineal Section.

Vital Dilatation is perhaps the method most generally applicable in ordinary cases of stricture, especially in private practice, and therefore I shall begin with it. By this method, I mean the introduction of an instrument through the contraction, and leaving it for a longer or shorter time for the purpose of promoting absorption of the new material which has caused diminution of the width of the canal; repeating this process every three or four days, and gradually increasing the size of the instrument until we can pass one which fully occupies the orifice of the urethra, which I have indicated as the natural gauge of the calibre of the rest of the canal. The principle upon which we proceed may be understood from what we find takes place in cases of retention in which we leave in a small catheter, say No. 1 or No. 2. After ten hours or less the urine is noticed to trickle along the sides of the instrument, as well as through it, and when, at the end of twenty-four or forty-eight hours, we remove the small catheter, which was at first tightly held, we find that a No. 4 can be passed with perfect ease, showing that, beyond the mere mechanical distension, vital causes have been acting on the organised material, and have led to its partial absorption. Indeed, at one time, this plan of causing rapid vital dilatation was used as a general method, instruments being introduced in succession, and left in until, at the end of a week, a full sized catheter could be passed. The excitement caused by such a procedure, however, is hurtful and dangerous; and, moreover, this treatment, even when not attended by constitutional disturbance, was found to be followed by rapid return of the contraction, and it is now, I think, abandoned. It was carrying a good principle to the extreme, without considering any-

thing but the local action. We may take advantage of it to gain ground until we can pass a No. 3 or 4 easily, but after that the dilatation ought to be carried out gradually.

To describe the proper treatment by dilatation succinctly, I will suppose that you have passed a No. 2 fairly through the stricture, and that it is tightly grasped. You leave it in the canal for five or ten minutes, and then withdraw it, and advise the patient to keep at rest as much as possible for a few hours. In many cases this is best secured by arranging to pass the smaller-sized instruments in the evening. If no great irritation follows, in three days you should again pass No. 2, leave it for a few seconds, and then pass No. 3, leaving it in for five minutes or so; and thus you proceed gradually, until complete dilatation is effected, always passing the size of bougie you used on the last occasion, and then the next larger size. Never yield to the temptation to gain ground by passing over one size, or by passing two larger sizes at a time. You are almost sure to excite undue irritation, and more likely to lose than gain ground. At the commencement of the treatment, when only the smaller sizes can be introduced, I prefer catheters, especially if there be any false passages, so as to make sure that the instrument is fairly in the bladder. When we reach the larger sizes, the metallic bougies answer better and produce less irritation.

As to the extent to which we ought to carry the dilatation of the urethra in organic stricture, my practice, in ordinary cases, is to take the natural orifice of the urethra as the gauge. An instrument which fully dilates that is, as a general rule, quite sufficient.

I have already alluded to the tendency to revive the practice of hyperdistension, which was at one time much in fashion. I consider that, as a general practice, carrying dilatation up to No. 13 or 14 of the metallic bougie or catheter gauge quite sufficient, and any further dilatation likely to do harm. If the patient be taught to introduce a No. 10, and does so once a week or fortnight, there will be little risk of the return of symptoms, but, unfortunately, patients generally neglect such precautions. There are cases, however, where hyperdistension is useful. In patients in whom the contraction has frequently returned, either from carelessness as to the precautionary after-treatment or in certain resilient strictures, I carry the distension up to No. 18 or 20 of the scale, doing so very gradually, and have done so with excellent results. But it should be regarded as an exceptional method of treatment. The class of cases fitted for it may occur in "runs," and in hospital might mislead as to the practice of the surgeon. During the past winter session, the greater number of cases in my wards were of a kind requiring hyperdistension, so that a stranger following my clinique might have supposed that it was my usual plan of treatment. We also occasionally meet with a case where the patient has diminished stream and some degree of urethral irritation, in whom the surgeon can pass No. 9 or 10 without difficulty, and where the stricture has been fully dilated. In such patients it will be found that the symptoms disappear under further dilatation, and in them hyperdistension is useful if carefully carried out.

In many patients affected with stricture the introduction of an

instrument, however gently and easily accomplished, is almost invariably followed by a rigor more or less severe. From what I have observed in such cases, I have come, rightly or wrongly, to associate this with irritation produced by the passage of the instrument over the prostatic portion of the urethra and neck of the bladder, and practically I have found that in most instances I can diminish or obviate this symptom by the following method :—When using small instruments, where I consider it essential to pass them into the bladder, so soon as the flow of urine satisfies me that this has been effected, I withdraw the catheter from the bladder and prostatic portion of the urethra, and leave it in the stricture ; and when passing larger-sized bougies I merely pass them fairly through the stricture, and no farther.

During the treatment by dilatation, the patient should avoid stimulants, and drink freely of diluents to allay the irritation of the bladder and urethra. When dilatation has been fully effected he should be taught to pass an instrument, and advised to use it once a fortnight, to prevent any tendency to relapse ; and this should especially be insisted on in the case of patients going abroad, or to places where surgical aid cannot be obtained. At the same time, I regret to say such advice is seldom long attended to ; the patients, after a time, gradually forget their former sufferings, and neglect to use the instrument until some difficulty in passing water shows that the contraction has returned.

There is another method of treatment, which used to be called vital dilatation by Dupuytren, and which has more recently been termed cross tunnelling, but which I think very dangerous. It consists in introducing an instrument down to the stricture, and tying it in, with the point resting against the obstruction. The principle of this plan is founded on the assumption that the force of the urine on the proximal, and the pressure of the catheter or bougie on the distal side of the stricture, will cause absorption to take place, and that ultimately the stricture will yield. The progress used to be measured from day to day by the stem of the catheter. I have repeatedly seen instruments passed in bit by bit in this way, until they should have passed into the bladder, but on examination it was found that they had only dilated false passages. In treatment by dilatation, therefore, we should always try to get the instrument into the bladder, and carry out the dilatation as I have advised, for that is the only safe plan of effecting our object.

LECTURE CXIV.

Treatment of Urethral Stricture, *continued*—Use of Caustics : their Dangers—Holt's Method of Immediate Dilatation—Precautions—After Treatment—Section of the Stricture from within by Lancetted Catheters—Perineal Section—Old Operation in Impermeable Contractions—Syme's Method : Description of the Operation—Special points to be attended to in Operating, and in the After-Treatment.

THE employment of caustics in the treatment of stricture was had recourse to in old times, in the first instance, in consequence of the erroneous pathological opinion that the obstruction was always due to the projection of caruncles or warts from the lining membrane of the urethra, the destruction of these growths being the object aimed at by this plan of treatment. In more recent times, the application of nitrate of silver in the treatment of stricture was revived by John Hunter, and subsequently extensively practised by Sir Everard Home and others. It was first used, not to destroy the contraction, but with a view of allaying the morbid irritability often present in cases of stricture. Some forms of stricture are excessively irritable, so that the passage of an instrument invariably gives rise to constitutional disturbance, as well as intense pain at the time. Hunter used the nitrate of silver in such cases at first, with the view of exhausting the morbid irritability of the part, and altering the action of the morbid surface, as we do in the case of irritable ulcer. To that extent the treatment was justifiable and useful.

It happened, however, that in some cases in which the caustic had acted more energetically than usual, the contraction was destroyed, and that large bougies could be introduced into the bladder more rapidly than by the ordinary treatment. This led to the caustic or armed bougies being used, so as to effect destruction of the contraction, as a method of treatment ; and this, as I have said, was at one time extensively practised, and is still, I believe, practised by some surgeons.

I consider that destruction of the contraction by caustic is exceedingly dangerous. I have treated and seen many cases of stricture in which caustic had been previously used, and have no hesitation in saying that they were the most troublesome and worst cases I have had to deal with. In most of them the complications of abscesses in the prostate, or fistula in perineo, were present, with irritable bladder and tendency to renal disease. In all, the strictures had become contracted and hardened by the application of the caustic, and had a constant

tendency to contract after dilatation, so that, before the use of perineal section, it was almost impossible to keep the canal patent by the use of instruments.

Whately and Wade's method, by the use of potassa fusa instead of nitrate of silver, which was attempted to be revived some twenty-five years ago, is, if possible, worse. I have in several cases seen false passages resulting from its use. In one instance a patient applied to me, saying he had a bad stricture. I used a No. 10 bougie, as I generally do when examining a patient for the first time. The instrument passed, with the greatest ease apparently, into the bladder, so that I could fully depress the handle, and feel its point free in a cavity. As it is not a very unusual thing to find, on examination of supposed stricture cases, that there is no stricture, I merely observed that, from the way in which the instrument passed, I did not think there was any great obstruction; on which the patient said, "The bougie has gone by the false passage, and if you examine you will find its point in the gut;" and so it was. The caustic had established a false passage into the rectum large enough to admit a No. 13 bougie, whilst a No. 3 catheter could only be passed with difficulty by the true passage through the contraction. I succeeded in curing the stricture by gradual dilatation, and the false passage contracted, but never closed completely, so that great care was required in passing instruments. Unfortunate results like these show the uncertainty and danger of using such agents as caustics, which may make a false passage for themselves, and which, even if they do pass into or destroy the contraction, only aggravate its condition ultimately, and predispose to abscesses in the neighbouring parts, and disease of other organs.

HOLT'S METHOD OF IMMEDIATE DILATATION, or rupture of the contraction, is the method of treatment which I consider most suitable for the treatment of tight firm strictures. If the kidneys and prostate gland are not diseased, this plan of treatment is, I believe, nearly, if not quite as safe as that of gradual dilatation, and I would always advise its employment in cases where the contraction returns quickly after dilatation; for although I do not believe that any method of treatment will absolutely preclude the return of the contraction, or that it is ever safe to neglect the occasional use of a bougie to maintain the patency of the canal, still the tendency to relapse seems less after Holt's method than after simple dilatation.

I was at first much prejudiced against this plan, owing to what I had seen of the effects produced by the forcible dilatation with the conical sound. In cases where that instrument had been used I had noticed that an irritable and resilient state of the contraction was the almost invariable result. From some opportunities I had of examining strictures dilated by this method, on the dead body, I found the mucous membrane at, and on either side of the stricture, fissured, and I considered this condition so similar to that of fissure of the rectum, that the intense irritability seemed to me referable to this fissured condition of the mucous membrane. Hence the immediate dilatation, by Mr. Holt's method, seemed to me as likely to lead to the same dis-

agreeable results ; but, after trying it in some cases, and having had an opportunity of examining a stricture which had been treated by his method, I found there was a difference between its action and that of the conical bougie. I saw that by his plan the stricture was fairly ruptured, not only through the mucous membrane but through the condensed submucous tissue forming the contraction. Now we know all that is required to cure the excessive irritability of fissure of the anus is division of the fissure fairly through its hard base ; and whilst we usually effect that with the knife, still it can be effected by the coarser method of forcible rupture with the fingers ; so that Holt's method, by fairly rupturing the hardened basement texture of the contraction, prevents, or even cures, the irritable condition of the stricture, and thus acts very differently from the partial fissuring of the mucous membrane caused by the conical bougie.

For the last twenty years I have practised Holt's method, and with great success, so that I feel no hesitation in recommending it as at once efficacious and safe—that is, *as free from danger as any operation on diseased urinary organs can be*. I need not repeat, that all the usual precautions must be taken that the patient be in a proper state for interference of any kind ; but I very seldom now have recourse to the large doses of quinine recommended by Mr. Holt as prophylactic. I believe nothing more is necessary than the ordinary attention to the general health, and state of the urinary organs, and characters of the urine. This preliminary treatment can be carried out whilst we continue ordinary dilatation up to the gauge of No. 3 catheter.

The operative procedure is very simple. The dilator is passed closed, till its point enters the bladder, and this is made sure of by withdrawing the stilette from the small tube within the dilator, when some drops of urine will flow by it if it has entered the bladder. But we must recollect that, from the form of the instrument, if it be passed far in its point rests against the walls of the bladder ; so that, if the urine does not flow, we should withdraw the point a little, and then the urine will come if the instrument is fairly in the bladder ; and we must make quite sure of that before we proceed to the next step. The rupture of the stricture is effected by loosening the screw which fixes the blades of the instrument, near the handle, so as to allow them to open. We then pass the dilator upon the tubular conductor, between the blades, and push steadily and forcibly till we feel the contraction yield. Lastly, the instrument is withdrawn, and a No. 10 or No. 11 catheter passed into the bladder and the urine drawn off. The patient is then desired not to make water himself, but to have his water drawn off with the catheter every six hours, for the first twenty-four.

I have always adopted this last precaution, although some consider it unnecessary ; but I regard it as a safeguard against infiltration ; and if we fairly rupture the contraction, as we ought to do, some infiltration might occur ; indeed, I have seen it take place in one case, that of a stricture about three inches from the orifice, which I split, and where the patient neglected the direction I had given. I am also aware that occasionally patients are told that there is no necessity for even remaining quiet for twenty-four hours, but that they may go about as

usual; but, in really serious cases of stricture, that is not safe advice nor judicious practice. Unless the natural orifice of the urethra is very small, I always at once use the largest of the dilators, so as to ensure complete rupture of the contracted portion of the canal and the surrounding condensed textures. At the end of eight or ten days I pass a No. 10 catheter; repeat this at gradually increasing intervals, and then instruct the patient to pass one for himself occasionally, so as to guard against relapse.

The treatment of old unyielding strictures, by dividing the contracted portion of the urethra with cutting instruments, has often been recommended. The method generally adopted was the old operation, termed "*la boutonnière*," which used to be practised at first only in cases of impermeable strictures arising from partial destruction of the canal, with a view of restoring its continuity, but gradually came to be used in cases called impermeable, where the surgeon could not pass an instrument into the bladder. The operation consisted in passing a full sized catheter down to the obstruction, cutting down upon it in the mesial line of the perineum, and dissecting backwards to try to find the urethra beyond the contraction, and then, after cutting through the dense intervening structure forming the contraction, passing the catheter onwards into the bladder, and retaining it there for forty-eight hours at first, and introducing it occasionally to re-establish the course of the urethra. This, however, was a most uncertain and difficult operation, as in the method adopted there was no guide to the posterior part of the canal amongst the altered textures, and when success was attained it was by chance. When I come to speak of puncture of the bladder, I shall point out how, by using a modification of the foregoing operation, the membranous part of the canal can with certainty be reached, so as at once to relieve the retention and re-establish the canal. But, as a method of treating stricture, the *boutonnière* is certainly not one which I should recommend, and I would specially guard you against confounding it with Mr. Syme's method of perineal section, which I shall describe immediately.

Division of the stricture from within has long been practised, especially on the Continent. I can hardly conceive any method more uncertain and dangerous. If the form of instrument used is such as not to pass within the contraction, but is only passed down to the stricture, and the lancet then projected with the intention of dividing the obstruction, it is more likely to cut the less resisting textures and form a false passage. If, on the other hand, the instrument is to pass within the contraction, before the lancet is projected, then a stricture which would admit an instrument of such a size does not require such a hazardous operation. Internal section of the stricture has again become fashionable, and it is with regret that I find it practised in Edinburgh, where the successful treatment of urethral stricture has been so long established on sound principles. In any form of division of the stricture from within with cutting instruments, the risks of bleeding and infiltration of the spongy texture of the urethra must be very great, as there is no external wound; and for my own part I consider it a method which should never be adopted.

PERINEAL SECTION, or EXTERNAL URETHROTOMY, for division of urethral stricture, as proposed by the late Professor Syme in 1844, and performed on the principles laid down by him, differs essentially from any of the foregoing methods for section of the contraction. It is an operation admirably adapted for the treatment of certain forms of tight or complicated stricture, attended with no great difficulty in its performance, not dangerous in itself, and attended with probably as little risk as any cutting operation can be in cases of diseased urinary organs. Since I began to use Holt's method I have not performed perineal section so generally as I formerly did, but for nearly twelve years, whilst I used dilatation in ordinary cases of stricture in private practice and in hospital out-patients, I performed perineal section almost invariably in all resilient, irritable, or old indurated strictures; and in the Edinburgh Royal Infirmary these were of frequent occurrence, and the results were most satisfactory. In the very few fatal cases which I have met with, the cause of death was almost invariably phlebotic pyæmia. I have never met with hæmorrhage or urinary infiltration, the bugbears which used to be urged against this method; and, therefore, though I now use Holt's plan in many cases where I should formerly have performed perineal section, yet in cases of cartilaginous, irritable, or resilient stricture, with induration of the perineal textures, or perineal fistula, I prefer perineal section by Mr. Syme's method to any other plan of treatment, and still frequently perform it. I have said that the operation is not difficult, and that its performance is effected with certainty if the principles laid down by Mr. Syme be attended to, together with some minute points in the manipulations, the neglect of which makes all the difference between a perfect and an imperfect operation.

I shall first briefly describe the mode of performing the operation, and then allude to the points which I consider as deserving special attention. The instruments required are a grooved stricture-staff, a small sharp-pointed bistoury, and a No. 10 silver or gum catheter. The perineum having been shaved, and the narrow part of the staff passed through the stricture fairly into the bladder, the patient is placed in the same position as for lithotomy, and the hips brought close to the edge of the table. The operator feels for the termination of the thick shoulder of the staff in the perineum, begins his incision over it exactly in the line of the raphé, and cuts backwards for about two inches. He next feels for the groove in the narrow part of the staff with the point of his right forefinger, and having felt the groove distinctly, he takes the handle of the instrument in his left hand, and guarding the point of the bistoury on his right forefinger, inserts it with its edge directed forwards into the groove, and carries it forwards through the stricture into the grooved part of the thick shoulder of the staff so as to divide the stricture thoroughly, and depresses the handle of the staff gently till he feels its thick portion pass fairly into the membranous portion of the urethra. Lastly, he withdraws the staff and introduces the full-sized catheter into the bladder, and retains it by tying it in position.

Such is the general description of the operation of perineal section.

The points deserving attention are, first, the instruments. The staff consists of an anterior thick portion, which should always be not less than the gauge of a No. 11 catheter, and should terminate in an abrupt manner, to mark the anterior boundary of the contraction. The narrow portion of the staff varies in gauge from No. 3 down to the small probe-pointed instrument for very tight strictures. The groove should be carried well up from the narrow into the thick portion of the staff, so as to allow the knife to cut freely forward. The set consists of four of these small instruments, and a small probe-pointed grooved silver director, used in cases of tight strictures in the anterior part of the urethra. The knife should be an ordinary small-sized bistoury in a fixed handle, very sharp at the point, with the back part of the point slightly bevelled off, by touching it on the stone in setting the instrument. The gum-elastic catheter is most suitable for leaving in the bladder; but in case of any difficulty in introducing the catheter owing to the point passing out of the wound in the urethra, the silver catheter should be at hand, as it can be guided with greater certainty. Secondly, as to the procedure, the staff should always be introduced fairly into the bladder, and entrusted to an assistant before the patient is placed in position for the operation. Immediately before commencing his incision, the surgeon should, by examining from the rectum, satisfy himself as to the staff being fairly in the bladder. In commencing the incision the thick shoulder of the staff forms an excellent guide as marking the anterior limit of the contraction, and therefore the incision should begin over it, and be carried backwards to the requisite extent. The incision must be exactly in the middle line or raphé of the perineum, and should be carried deeply at once, especially as it passes backwards from the thick part of the staff; by so doing we avoid the risk of lateral dissection in the deep part of the wound, and the danger of going to one side of the small grooved part of the staff, and come directly down upon it. In cases of indurated perineum, where we might expect great difficulty, we often find the narrow grooved portion of the staff very easily, as the textures do not yield laterally or separate. Moreover, by a decided deep incision in the middle line we incur less risk of hæmorrhage. On completing this incision, the operator should pass his right forefinger into the posterior part of the wound, and with the pulp of the finger directed forwards, feel for the groove in the narrow part of the staff, behind or on the vesical aspect of the stricture. If the incision has been deep and well placed, he will generally feel the staff easily; if not, he must touch the textures with the knife directed in the middle line, until he feels the groove almost bare. It is at this stage that an error is apt to occur, unless you attend to a point which you might possibly think of but little consequence in the description of the operation as given by Mr. Syme, but the neglect of which, I am satisfied from experience, was often the cause of difficulties and imperfection in our earlier operations for perineal section. Mr. Syme directs that, on the groove being felt, the knife, guarded on the forefinger of the operator's right hand, should be inserted into the groove; in other words, whilst the point of the forefinger has felt and is fixed against the groove, the knife, which has been lying upon the finger, is projected forwards so that it must

enter the groove. It cannot pass to either side, and hence is directed at once into the centre of the groove, however narrow that may be, and easily carried through the contraction by pressing it forwards by the finger placed behind it. If, on the contrary, we do what was very generally done in the earlier operations for perineal section—viz. use the finger of the left hand to feel for the groove in the narrow part of the staff, as is done in lithotomy, and then pass the knife over the nail of the left forefinger which is fixed in the groove as a guide—the knife is directed to one side, misses the small groove, and is carried along the side of the staff, thus leading to an imperfect incision, or to uncertainty as to complete division of the stricture. I repeat that this apparently trifling manœuvre is of the greatest importance as to the ease and certainty with which the stricture will be divided. The edge of the knife should always be carried well forward into the groove in the thick portion of the staff. There is another precaution which I take at this stage, and which I consider should never be neglected. When the stricture is divided we are told to withdraw the staff and proceed to introduce the catheter. But we must first make quite sure that the whole contraction is divided. The limit of the stricture in front is well marked by the thick shoulder of the staff arrested there, but the posterior limit is not so surely marked; we judge of that chiefly by feeling the groove less thickly covered. Even as regards the anterior part, a few fibres may escape from the action of the knife, but we can give perfect certainty to the complete section of the stricture by using a very simple precaution. Instead of withdrawing the staff I pass my left forefinger into the wound, and with my right hand depress the handle of the staff so as to carry it towards the bladder. If the contraction be fully divided the thick part of the staff passes on easily beyond the cut in the urethra into its membranous part, and its position is felt by the finger in the wound. If, on the contrary, there be any catch or hindrance, I never attempt to force the staff onwards; but, again using my left hand to steady the staff, I re-introduce the knife on my right forefinger and divide any resisting fibres, whether at the anterior or posterior part of the urethral section, until the staff glides easily onwards. No force to overcome a difficulty should be used. It may be that a small portion of the anterior boundary of the contraction has escaped complete division; very little propelling force would overcome this, as the remains of the white fibrous texture would readily yield for the time, and permit the instrument to be carried on towards the bladder; but the operation would be incomplete, and contraction would soon return. Moreover, by this same precaution, the introduction of the catheter is rendered more easy and certain.

As regards the introduction of the catheter, we should be careful to keep the point of the instrument bearing gently on the upper or pubic wall of the urethra, to avoid the risk of its passing out through the section, and getting entangled in the tissues of the wound. Should any hitch occur, do not press on, but withdraw the instrument, and introduce it again, keeping the finger of the left hand in the wound to guide its point if necessary. I have already said I prefer the gum-

elastic catheter to be retained in the bladder. It is best secured in position by means of a silk thread tied round the ivory mouthpiece of the instrument, the ends of which are carried back, one on either side of the glans penis, and secured by a circular strip of adhesive plaster. If a silver catheter be used it should have a very short point. We secure it in the following manner, which is that used for securing the silver catheter under any circumstances:—A broad bandage is tied round the abdomen above the pelvis. To this we fasten two perineal loops on either side. These loops are simply narrow strips of bandage, brought obliquely from under the perineum on each side, and tied to the abdominal bandage. Through each ring of the catheter a narrow strip of oiled silk, or a piece of thin string, waxed or oiled, is passed, and the ends secured to the perineal loops on each side.

Care should be taken not to tie the catheter too far in, nor to allow the water to flow off through it continually, because the small thickened bladder will contract on the point of the instrument, and ulceration of the mucous coat may ensue. This happened in one of my cases, at a time when, from dread of the risk of infiltration, which was then so much spoken of, the practice was to allow the urine to flow off continuously. Since then I have almost invariably used a gum catheter, and in all cases I leave a plug in the instrument, which can be withdrawn when necessary. Bad results might occur from tying in a full sized instrument for any cause, if the bladder is permitted to be constantly empty, owing to the continuous draining away of the urine.

The after-treatment of perineal section is very similar to that of lithotomy cases—anodynes at first, and the free use of diluent drinks, to allay irritability of the bladder. The catheter should be withdrawn at the end of forty-eight hours, or earlier, if it cause much irritation. At the end of ten days a No. 8 or No. 9 catheter should be passed, and then at intervals of eight days, as the wound heals. For the first fortnight the patient should be kept in bed, but after that he may be allowed to sit up, or walk about, unless the wound be irritable.

In concluding this important subject, I would briefly state, in a dogmatic form, the methods of treatment I should recommend in cases of stricture.

1st. In the simpler cases of non-irritable stricture, and where the patient cannot conveniently be confined to the house, even for a few days, vital dilatation methodically carried out on the principles I have laid down.

2d. In more severe, irritable, indurated, and resilient strictures, I prefer Holt's method of splitting the stricture, as it involves very little risk, is uncomplicated with wound, and is therefore attended with less necessity for confinement in the after-treatment.

3d. In tight cartilaginous and irritable strictures, with induration in the perineum or abscess, or complicated by fistulous openings, I would recommend perineal section on Mr. Syme's principle.

LECTURE CXV.

Puncture of the Bladder for Retention of Urine in cases of Stricture—Puncture by the Rectum: 1, Incision from the Perineum—Extravasation of Urine—Symptoms of rapid Extravasation from yielding of the Urethra behind the Stricture—Treatment—Extravasation resulting from neglected Urinary Abscess—Fistula in Perineo—Different forms of Perineal Fistula, and their Treatment—Retention of Urine and Catheterism in the Female.

OCCASIONALLY, but very rarely, cases of retention occur in which the surgeon requires to puncture the bladder. There are two methods of doing this. The bladder may be punctured from above the pubes, as already described when speaking of diseased prostate, or by the rectum in cases where the prostate is of its natural size. The latter is a very simple mode; rather too simple in fact, because some surgeons seem much inclined to resort to it rather than persevere in attempts to pass the catheter. In retention of urine from stricture, unless there be absolute obliteration of the canal, the surgeon ought to be able to pass a catheter. If he perseveres skilfully, he will hardly ever fail in doing so, though it requires, as I have already shown, skill, determination, and experience. Sometimes it may happen that a person who has had few opportunities and little experience in treating stricture will be called in to a difficult case; and then, if he cannot obtain further aid, puncture of the bladder by the rectum is certainly preferable to delay, or dangerous efforts with the catheter. When the bladder is distended, and the prostate healthy, the bladder bulges towards the rectum and between the vasa deferentia and vesiculæ seminales. There is a point below the reflection of the peritoneum from the rectum to the bladder, where that viscus is in close contact with the bowel (plate XXXVII., fig. 2). Should the prostate be injured by the trocar, a prostatic fistula is apt to develop, which often proves very intractable.

In puncturing the bladder from the rectum, the surgeon passes two fingers into the rectum, till he feels the base of the prostate. He then takes a curved trocar and canula (Poubeau's)—the trocar being drawn back within the canula—presses the point of the canula against the bulging portion of the bladder, as represented in fig. 230, and then pushes the trocar onwards until perforation is effected, and the urine evacuated. The canula is then tied in the rectum, projecting into the bladder, and left there for forty-eight hours, until the surgeon is able to introduce a catheter and dilate the urethra, which can often be more readily done after the bladder is relieved and the congestion and irritability of the canal allayed.

I have only twice punctured the bladder from the rectum. *Once, forty-one years ago, in a man who had been previously subjected to rather rough catheterism, and who would not submit to any further trial of the catheter. There could have been no real necessity for puncture, as I passed a No. 6 catheter easily two days afterwards. The second case occurred in my hospital practice, and was rather

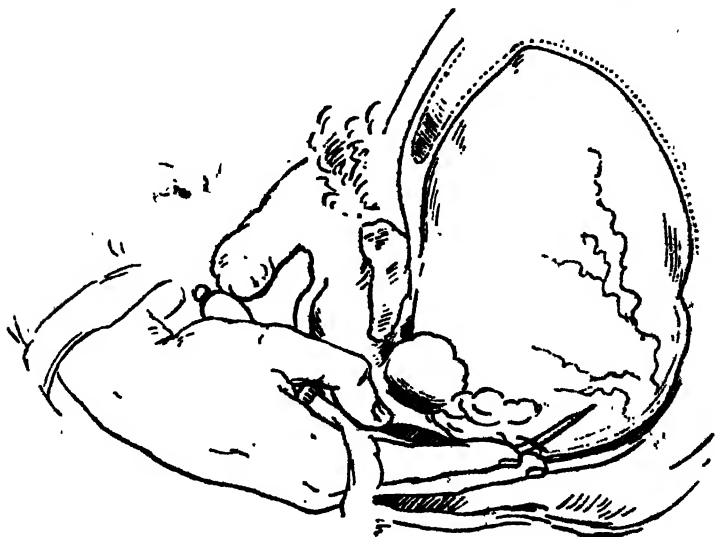


Fig. 230.

puncture of a vesical cyst than puncture of the bladder in the usual way. A full-sized catheter was introduced into the bladder, and relieved it, but not the distended cyst, which communicated with the bladder by a small indirect orifice, and therefore puncture of the cyst was absolutely necessary. (See Clinical Cases.)

When, from any cause, it is necessary to resort to an operation to relieve the distended bladder, there is another method which is, I think, much better than puncture by the rectum.

Where there is absolute obstruction of the urethral canal from injury or disease, we have a fixed and sure guide to opening into the membranous part of the urethra. By passing the forefinger of the left hand into the rectum we can feel the apex of the prostate gland distinctly, and in front of the prostate the dilated membranous portion of the urethra can be reached and opened with safety. In operating, the surgeon, having his finger in the rectum in contact with the prostate, takes an ordinary straight bistoury and plunges it into the mesial line of the perineum, in front of the anus, with the back of the knife towards the coats of the rectum, and, keeping its point directed obliquely upwards, he cuts freely, as if he were going to cut into the apex of the prostate. That gland forms a fixed point, in front of which he cuts into the membranous part of the urethra (fig. 231), and

Fig. 230. Puncture of bladder from the rectum, as described in text.

the urine then escapes. Afterwards, he either leaves in a lithotomy-tube or introduces a catheter down to the obstruction in the perineum, cuts on its point, and passes it on to the bladder, so as to re-establish the urethra. This may seem a difficult operation, but it is really not so. It is, I think, a much safer and better operation than puncturing the bladder from the rectum, as it not only relieves the retention but

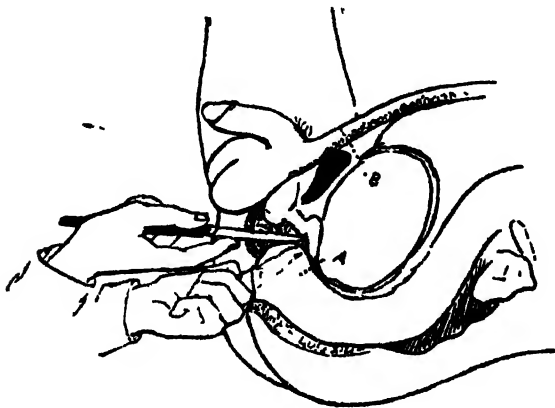


Fig 231

enables us to restore the natural passage. It can, however, only be required in cases where the continuity of the canal of the urethra has been destroyed by injury, and where, therefore, a catheter cannot be passed, or when the scrotum and penis are involved in a cancerous swelling. I have performed the operation several times under both of these conditions, and met with no difficulty. .

EXTRAVASATION OF URINE may occur from various causes, some of which, such as injuries of the urethra and bladder, have been already spoken of. When the extravasation takes place in certain positions, as at the neck of the bladder within the pelvis, or when it escapes into the abdominal cavity, we have seen that the condition is one which does not admit of much being done for its relief. It is different, however, with respect to extravasation or infiltration of urine in the perineum. In that case we can do much to save life, and prevent, or at least diminish, the destruction of tissues, if only our interference be prompt and decided, and I therefore desire to draw your attention very specially to this subject. It is not a condition in which you can wait to have a consultation or obtain aid. To be of service you must act at once, and understand how to act, and the principles on which you proceed.

I have said that extravasation may arise from injuries of the urethra and other causes; but in this position it most usually occurs in

Fig. 231. Puncture of bladder from perineum, author's method, as described in text.

consequence of obstruction in the canal, and in connection with urethral stricture.

There are two forms in which it may arise. One almost instantaneous in its occurrence, rapid in its destructive effects, and attended with very marked local and constitutional symptoms. The other, preceded by the formation of deep abscess in the perineum, and only supervening as a consequence of that having been neglected, and hence its progress and symptoms are different from those of the former, and perhaps not attended with so much, at least not with such immediate, danger.

I shall first describe the condition in which the urine escapes and is rapidly extravasated into the tissues. This usually occurs in cases of tight indurated strictures. In such instances there are always pathological changes, tending to ulceration of the urethra behind the stricture, resulting from long continued irritation, and the pressure of the urine from behind over-distending the canal immediately on the vesical aspect of the contraction; and in cases of retention under such conditions, unsuccessful attempts to introduce catheters may also tear and still further weaken the walls of the urethra. Under such circumstances the patient, straining with great force to empty the over-distended bladder, feels something give way, and experiencing the relief of the bladder evacuating its contents, thinks he is making water, but seeing none coming by the natural passage, he becomes alarmed, especially when he finds a sudden swelling between his thighs, and distension of the scrotum and penis. The urethra has yielded in the perineum behind the stricture. The momentary relief is soon followed by an intense burning sensation in the perineum, and medical aid is procured.

If the surgeon sees the patient immediately after the occurrence of the extravasation, he finds the scrotum and coverings of the penis swollen and tense, and the anterior part of the perineum occupied by a tense prominent pyramidal swelling, at first sharply defined. This perineal swelling is continuous in front with that of the scrotum; its apex, posteriorly, in the middle of the perineum, passes no farther back than about three-fourths of an inch from the anus; but laterally and posteriorly it approaches the point of junction of the ramus with the tuber ischii. Laterally it is defined by the line of the rami of the ischium and pubes on each side. After a time the definition may be less marked, owing to acute œdema of the subcutaneous tissue supervening. If the extravasation is allowed to proceed, the swelling passes up along the course of the spermatic cord to the lower part of the abdomen.

It is of importance to notice the form and course of the swelling as seen at the early stage, as that explains the site of the extravasated fluid, and indicates the measures necessary in the treatment. An examination of such cases shows that the urethra has given way behind the stricture, very generally just behind the bulb, and that the urine is extravasated between the triangular ligament and the true superficial fascia of the perineum. The superficial fascia of the perineum, after passing over the muscles covering the bulb and crus

penis, and the transverse muscles of the perineum, is reflected or passes deeply behind the last-mentioned muscles, and becomes intimately united to the posterior margin of the triangular ligament. Laterally, as it ascends, it covers in the crus penis on each side, and immediately external to the crus it becomes firmly connected to the fascia covering the muscles of the thigh, which arise from the rami of the pubes and ischium. Anteriorly, at the scrotum, it is continued as a part of the coverings of the scrotum and penis, and thence along the cord to the lower part of the abdomen, where it can be traced as continuous with the fascia of Scarpa or deep layer of the superficial abdominal fascia. The anatomical arrangement of this fascia determines the position of the swelling caused by the effused fluid in extravasation, and the course which that fluid takes.

It will be at once seen that in the perineum the connections of the superficial fascia and its relation to the triangular ligament form a sac closed posteriorly and laterally, so that fluid effused between the triangular ligament and the superficial fascia cannot gravitate or pass back towards the anal or posterior region of the perineum, or laterally towards the thighs, but must necessarily pass forwards and upwards to the mouth of the pouch, where the superficial perineal fascia becomes continuous with the coverings of the scrotum, in which direction it finds a ready vent into the loose cellular tissue under the coverings of the scrotum and penis. In cases where the urethra gives way a little in front of the bulb, besides the swelling described being present, a portion of the urine sometimes infiltrates the erectile spongy texture, causing gangrene, which is indicated by the glans penis becoming black, or presenting black spots on its surface and in its substance. The condition thus indicated is one of great danger, and the prognosis most unfavourable.

In the course of a very short time the swollen and distended parts become discoloured, at first of a dusky red, and then mottled with black patches, and the character of the swelling gradually alters. It becomes boggy and emphysematous, rather than tense, and the same condition extends over the abdomen, ascending gradually higher and higher unless interfered with.

These local conditions speedily give rise to marked constitutional symptoms. The patient becomes feverish and excited, with a quick, sharp, or jerking pulse. The fever soon assumes the irritative typhoid character. The tongue becomes dry, the skin is covered with profuse perspiration, and exhales a urinous odour, then low muttering delirium, fumbling with the hands, cold clammy sweats occur, and finally, unless decided measures be resorted to at once, coma and collapse close the scene.

When called to a patient suffering from extravasation of urine, the character of the swelling, in conjunction with the circumstances accompanying it, should leave no doubt as to the nature of the case; and the treatment, to be effective, must be immediate and decided. No delay is warrantable, even though the constitutional symptoms may not have arisen; our object, indeed, should be to prevent or diminish these. There is no use in wasting time in attempts to pass the catheter; for

even supposing you managed to get it into the bladder, it would do little or no good, for the contents of the bladder have been already extravasated amongst the tissues, and you must relieve that condition by free incisions.

To evacuate the extravasated fluid and sloughs of cellular tissue destroyed by the action of the urine, you must make a free and deep incision in the middle line of the perineum, from behind the lowest part of the perineal swelling forwards to the root of the scrotum, and lateral incisions also in many cases. Incisions must also be made into the scrotum, coverings of the penis, and into the boggy swelling over the cord and abdomen. In a word, wherever the swelling indicates that the urine has infiltrated the tissues, there we must incise freely to permit it and the sloughs of gangrenous tissue to escape. The perineal incisions must be deep and long, so as to pass through the fascia, and any sloughing fascia or tissue should be pulled out or clipped away, as it is a source of irritation, and acts also as a mechanical barrier to the escape of the discharge.

When acute oedema has supervened, it is especially necessary to be on your guard against being misled by the apparent depth of your incisions, or the escape of serous fluid. Through the long central incision in the perineum, if properly made, and of sufficient depth, you can introduce your finger and feel the bulb and other deep structures. Punctures or small incisions, even if deep, are of no use. Part of the urine may escape in a fluid state, but the greater part is infiltrated into the cellular tissue, and incorporated with it, and therefore free deep incisions are absolutely necessary to relieve this state of the parts. When the sloughs and fluid escape, and the swelling subsides, you will find what, in the tense state of parts, appeared formidable-looking incisions, become very moderate in their dimensions. Besides the absolute necessity for free apertures of exit, by pursuing this course we really save tissues which would otherwise infallibly slough and be lost.

It is very seldom that any dangerous amount of bleeding follows the incision of the parts, but if any superficial vessels bleed smartly, it is necessary to tie them and cut off the ends of the ligatures. The subsequent local treatment consists in applying poultices with charcoal for some time, till the sloughs are fairly thrown off; afterwards various lotions are used, according to the appearance of the granulating surface. When the swelling is partially diminished by the incisions, we can introduce the grooved stricture-staff through the contracted urethra into the bladder, and use the central incision to reach the groove and divide the stricture, and then pass and retain a full-sized gum catheter in the bladder.

The constitutional symptoms are most likely to be relieved, if not prevented, by the active local treatment; but if they have arisen before the patient has been seen by the medical attendant, then stimulants to keep up the strength, and bromide of potassium, with camphor, to allay the general irritative fever, and subsequently generous diet, form the chief indications.

Occasionally extravasation occurs in a more insidious form from

some small rent or ulceration of the urethra, and then urine, escaping slowly in small quantity, does not give rise to the marked swelling I have described, and attention may only be drawn to it by the occurrence of the constitutional symptoms. In such circumstances the patient's condition is very dangerous, but treatment by incisions to evacuate the urine and sloughs must be had recourse to as in the former case.

The other form of urinary extravasation which supervenes on neglected abscess in the perineum arises in a different manner from that which I have just described; and, accordingly, its symptoms are different and its progress less rapid, in consequence of the pathological changes which have preceded the extravasation limiting it for a time. Owing to the presence of stricture, or some other source of irritation in or near the urethra, deep-seated inflammation is set up in the perineum; and, as a result, an abscess or collection of pus forms either under the superficial fascia or between the layers of the triangular ligament. This is attended by deep-seated brawny hardness in the perineum, accompanied by great pain and constitutional disturbance, acute oedema of the scrotum, and, in most instances, painful and difficult micturition, and pain and fulness about the anus. If these conditions be neglected, or if the surgeon waits for distinct fluctuation, the purulent matter, prevented from making its way towards the cutaneous surface, points and opens into the mucous canal of the urethra. In consequence of this ulceration, whilst part of the pus escapes by the urethra, urine passes, more or less freely, into the cavity of the abscess, and excites increased action of an unhealthy character, constituting urinary abscess, and attended with the peculiar constitutional symptoms of urinary fever.

For a time the effused urine and purulent matter are confined by the barrier resulting from the plastic exudation which has consolidated the tissues and formed the cyst of the abscess, and hence the fluid is not largely extravasated as in the ordinary form of infiltration of urine. Unless, however, free vent be given to the collection, the barrier soon yields before the pressure and destructive action of the acrid fluid, and then the fluid contents gradually infiltrate the surrounding parts, and lead to sloughing and unhealthy suppuration, undermining and destroying the deep as well as the superficial structures, and ultimately, though more slowly, the fatal results follow as in the former case, or the patient may die with the symptoms of a combination of pyæmia and uræmia. The pathological condition indicates the proper treatment, namely, early incision in all cases of suspected suppuration in the perineum, without waiting for fluctuation. When the symptoms of deep inflammation in the perineum have been followed by escape of pus by the urethra, without much diminution of the perineal swelling, and with perhaps increased local and constitutional irritation, no time should be lost in making a deep incision into the perineum to afford vent to the confined fluids, and so prevent mischief. Should the urine have made its way through the consolidated tissue forming the boundary cyst of the abscess, and become infiltrated, we must make incisions along its course, and apply charcoal poultices and fomentations, as in

the usual form of extravasation of urine, to allay irritation and favour the escape of sloughs of dead tissue, whilst at the same time we support the patient's strength by stimulants and nutrient diet.

When speaking of the various pathological conditions arising in consequence of urethral stricture and complicating its treatment, I mentioned FISTULA IN PERINEO, and stated how it originated in abscess, and was kept up by the urine passing through the fistulous track so long as the contraction remained in front. When this condition has continued for some time, the sinuses and the main fistulous canal connected with the opening in the urethra behind the stricture become much consolidated, and lined with a structure resembling mucous membrane. In many cases the whole perineum and posterior part of the scrotum present fistulous openings converging at the main track, and all the surrounding textures are thickened and consolidated owing to plastic exudation. In such cases, the first and most important indication for treatment is to restore the natural passage by curing the stricture. When that is done, nature in many instances accomplishes the rest of the cure, the urine flows by the natural canal, and the sinuses gradually contract and heal. In some cases, however, where great induration and many tortuous sinuses have existed for a long time, we may require to lay them open to some extent, and use a stimulant application, or the actual or potential cautery, to destroy the lining membranes and callous tracks of the fistulæ. This is best effected by means of the heated wire, or a probe coated with nitrate of silver, or by injecting a solution of nitrate of silver along the track, and when there is much consolidation and brawny hardness of the perineum, the application of a blister is of great service in promoting absorption of the plastic exudation, and stimulating the parts to a healthy action.

We must, however, remember that fistula in perineo may depend on other causes than stricture, or be kept up by a state of parts which renders it much less amenable to treatment, or even incurable. In cases where abscess forms from any cause in Cowper's gland, even although it is opened early, there is often a tendency to the formation of a troublesome urinary fistula. The short duct of the gland opening into the sinus of the bulb is involved in the diseased condition, and hence the ulceration opens into the urethra, and urine dribbles through the abscess, and, though there be no obstruction in front, keeps the external aperture from contracting, and this condition is very troublesome and tedious of cure. The best plan is to lay open the fistula and cavity of the abscess, and touch the interior with strong tincture of iodine or nitrate of silver, and let the wound granulate from the bottom, and after a time apply the heated wire to complete the cure. Some recommend that a gum catheter should be retained, or that the patient should be taught to use the catheter to draw off the contents of the bladder, so as to prevent the urine passing into the sinus; but the irritation produced by the catheterism is as bad as that induced by the dribbling of urine; besides, in such cases where there is no stricture, a part of the urine always passes by the sides of, as well as through,

the catheter. In the cases in which I have tried catheterism, it has retarded rather than expedited the cure.

It has been recently proposed that in cases of fistula where there is no obstruction anteriorly, puncture of the bladder and retention of a soft canula should be resorted to, so as absolutely to prevent urine flowing along the urethra for a time, and in cases which resist other treatment the suggestion is worthy of trial.

In patients in whom, as a consequence of stricture, chronic abscess of the prostate gland has occurred in the form alluded to when speaking of the morbid changes following bad strictures, the pus is often discharged by ulceration through the mucous membrane lining the prostatic portion of the urethra, and consequently, when the patient makes water, part of the urine finds its way into the prostatic abscess, and leads to further suppuration, and fistula opening in the perineum, through which foetid pus and urine find vent. For the cure of the contraction, dilatation or other treatment of the stricture is in such circumstances indicated in the first instance, but we can hardly expect it to cure the fistulous condition, depending as that does on the disorganised state of the prostate. I possess a specimen in my collection from a patient in whom a fistula in perineo existed for many years. The stricture was fully dilated and cured, but, though most of the urine passed by the natural passage, a small fistula remained open, which could never be healed. The preparation of the morbid parts shows the reason of its incurability to be the state of the prostate and prostatic portion of the urethra with which the sinus communicated. In the case of a young man recently under my care, who suffered from urinary fistula connected not with stricture, but arising from a strumous abscess of the left side of the prostate, after having diagnosed the condition by examination from the rectum, I divided the sinus by an incision resembling that for lithotomy, and laid the cavity in the left side of the prostate freely open. The incision contracted and healed, but a similar abscess formed on the right side of the prostate, and ulcerated into the rectum. Under treatment this also contracted, but never completely, and abscess of the testicle supervened. After long treatment the patient was dismissed relieved, but I can hardly say cured; indeed the state of his general health was most unfavourable for any treatment. In this class of cases incision of the prostatic abscess, combined with puncture of the bladder, may be warranted, if the general health is not too much affected.

In cases where great sloughing has followed extravasation of urine, it often happens that, whilst the gap caused by the separation of sloughs contracts and heals to a wonderful extent, a small fistulous opening remains. You must be very careful in your prognosis as to the curability of such a fistula. It looks so trifling that you are apt to imagine that, by dilating the stricture and touching the fistulous opening with the heated wire, there will be no difficulty in obtaining a cure. But you must recollect what has occurred. All the deep textures and a portion of the urethral wall have been destroyed, and though, by the process of contraction the skin has nearly closed, it merely covers in a cavity, in which, when you pass an instrument into the bladder and

enlarge the opening in the perineum, you can feel the catheter bare for an inch, or even more. Such a case may be pronounced incurable, for the only chance of a cure is by means of a plastic operation, and the condition of parts is very unfavourable for that.

I have dwelt at length on the subject of perineal fistula, because, whilst the general principle of treatment and the favourable prognosis in ordinary cases connected with stricture are in consonance with what I first stated, the exceptions are so important and so little adverted to, that I considered it essential to draw your attention to them.

RETENTION OF URINE IN THE FEMALE, owing to the short and direct course of the urethra and its large calibre, is not of frequent occurrence; but it occasionally arises from malposition of the womb, as in cases of ante flexion and retroversion of that organ, and from the pressure of firm polypi, fibrous tumours, or other growths projecting from the uterus into the vagina. I have met with complete retention, and enormous distension of the bladder, arising from accumulation of the menstrual discharge in a case of imperforate hymen. Retention of urine may also occur during labour, if the attendants neglect to have the bladder emptied before the head of the child descends so as to compress and alter the position of the urethra; and it also sometimes results after tedious or difficult labours. Atony of the bladder from over-distension, or paralysis from disease of the nervous centres, may, as in the male, occasionally lead to retention, but comparatively rarely, as the size and shortness of the passage allow the urine to flow off. Stricture of the female urethra is an exceedingly rare disease, but it is occasionally met with, and most generally arises from some local injury of the passage. The orifice is not unfrequently obstructed by caruncles or warty growths, and one peculiarly painful growth, situated at the orifice of the urethra, sometimes causes complete retention of urine from sympathetic irritation, and the excessive pain caused in micturition. The growth is prominent, often pedunculated, and has the appearance of a small raspberry.

In most instances there is no difficulty in relieving retention of urine in the female by means of catheterism, but, except in cases of unusual character, no exposure is permissible, and hence the introduction of the instrument requires some tact. The direction usually given as the best to guide the instrument into the orifice of the urethra, and avoid the more patent orifice of the vagina, is to pass the finger from the vestibule backwards until the point of the finger feels the papillary swelling of the urethral orifice. In many cases where we require to use the catheter, as in women who have borne children, the urethral orifice almost lies within the dilated vagina. The surest plan in all cases is to place the forefinger of the left hand in the vagina behind the orifice of the urethra, and with the catheter carried on the forefinger of the right hand to guide the instrument into the orifice. The position of the left forefinger prevents the instrument passing into the vagina, or if it tends to do so, detects the error at once, and then, by guiding the catheter a little forwards, it almost certainly enters the proper canal, and is easily carried on towards the bladder. A short

flattened silver catheter is generally used, and answers well enough. The ordinary gum-elastic male catheter, without the stilette, will however, I think, generally be found more useful for all purposes. It is easily introduced, adapts itself readily to any alteration in position or length of the canal, which may be caused by the pressure of tumours or the displaced uterus, and avoids the urine wetting the patient or bed-clothes, which is liable to occur when the short catheter is used ; and, moreover, avoids still more surely all exposure of the patient.

When retention arises from some special cause, that of course must be attended to, besides relieving the bladder with the catheter. Thus, in the case of retained menstrual discharge, the hymen must be divided by a small crucial incision ; the opening dilated with the finger, the collected discharge evacuated, and the vagina washed out with tepid watery solution of carbolic or boracic acid, and an opiate given, as considerable irritation and even danger of metritis sometimes follows this simple operation.

When caruncles or the painful vascular wart like growths are present, they must be removed by ligature, or the knife or scissors, and the cut surface touched with nitrate of silver. Polypoid tumours of the uterus must be removed if their character and attachments admit of that being done, and in cases of ante- or retro- version of the uterus, means must be taken to replace and maintain the organ in its natural position.

Should an organic stricture be found, it will be best treated by gradual dilatation, or by splitting it, as in Holt's operation in the male, and then the patency of the canal must be maintained by the occasional use of a bougie or catheter.

LECTURE CXVI.

URETHRITIS—Gonorrhœa Virulenta: its Progressive Symptoms—Gleet—Retrocedent Stage—Complications—Prostatitis and Irritable Bladder—Inflammation of the Testicle—Treatment of Gonorrhœa and Gleet—Gonorrhœa in the Female—Constitutional or Secondary Effects of Gonorrhœa Virulenta—Gonorrhœal Ophthalmia—Gonorrhœal Warts—Gonorrhœa Præputialis.

INFLAMMATION of the mucous lining of the urethra, attended with pain and irritation of the parts, and pain during micturition, accompanied by the discharge of viscid muco-purulent matter, may arise from various causes not venereal, such as direct local irritation, or from affections of other organs leading indirectly to irritation of the mucous membrane, constituting URETHRITIS or GONORRHŒA SIMPLEX. The term gonorrhœa was originally applied to all urethral discharges, under the idea that the irritation led to over-secretion and discharge of altered seminal fluid; and although this erroneous notion has long ago been exploded, the term from custom is still retained.

The form of urethritis which we have to treat most frequently is an inflammation of a specific character, arising from the application of a virus to the mucous surface, and hence it is termed GONORRHŒA VIRULENTA, not on account of the virulence of the symptoms, but to distinguish it from the simple form, as arising from a special virus, and by the poison power the discharge possesses of communicating a similar disease when applied to a mucous surface.

At one time gonorrhœa and syphilitic affections were all included under the one head of venereal diseases, a nosological arrangement which led to lamentable results in practice, from the treatment adopted, in consequence of the idea that these diseases were identical in nature. In the present day, and indeed for a long period back, I believe that no one holds or has held such a view. Some, however, have gone to the opposite extreme, and consider that there is no evidence of specific character in gonorrhœa—that the disease is simply to be regarded as discharge arising from inflammatory action, and possessing the same characters whether the inflammation be excited by some accidental local irritant or by impure sexual contact.

Whilst I readily admit that any acrid discharge or other irritant of a non-venereal character applied to the urethra may excite all the acute symptoms of the inflammation and the purulent discharge, yet such an irritant will never produce certain specific symptoms which we meet with in many cases of gonorrhœa virulenta, and which are liable

to occur in all, if proper treatment be not adopted. I allude especially to the peculiar lichenous eruption, and the acute or subacute forms of articular rheumatism, which frequently supervene during the retrocedent stage of the affection (and the gonorrhœal ophthalmia and otorrhœa which occur when the discharge has ceased or been suddenly arrested), and which cannot be accounted for on the supposition of direct application of the discharge to the part. Such constitutional affections never follow on simple urethritis, and the period at which, and the manner in which, they occur seem to me distinctly to indicate the specific character of gonorrhœa virulenta.

One reason why I have drawn your attention to this character of the disease is, that in gonorrhœa, as in most diseases arising from a specific virus or infection, we have it running its peculiar course, and undergoing a series of natural changes, the observation of which may form indications for, or may modify its treatment. Thus, from the period of accession, we find a gradual increase in the violence of the symptoms up to the eighth or tenth day, when it culminates; and from that period the violence of the pain and amount of the discharge diminish, and the character of the discharge alters. During the retrogressive stage, affections of some of the other organs connected with the urethra by function and continuity of mucous surface, such as Cowper's glands, the prostate and testicle, may and often do supervene; and, as I have already stated, it is at this period that the secondary or constitutional symptoms often show themselves.

I shall now proceed to describe, as briefly as I possibly can, the symptoms of a case of gonorrhœa virulenta. A period of incubation, varying from three to eight or ten days, seems generally to intervene between the receipt of the infection and the manifestation of the symptoms of the disease. Most generally about the sixth or seventh day the patient feels an uneasy, irritable, or itching sensation about the orifice and anterior part of the urethra, and on looking at the parts he observes that the lips of the orifice are red and swollen. When he passes water the stream scatters, and micturition is followed by increased irritability of the passage. The irritable sensation soon changes to that of pain of a sharp burning character, and then there is noticed a purulent discharge, at first small in quantity, but which soon becomes profuse. The inflammatory swelling of the orifice is increased, and there is often swelling of the prepuce from acute œdema. The pain on micturition is now so intense and burning in its character that the patient dreads to relieve the bladder, and in some cases the agony is excessive. The constitution sympathises, and there is always more or less fever and disturbance of other functions, while in some patients the symptomatic fever runs very high. Little hard masses and inflamed absorbents can often be felt along the penis, and the absorbent glands in the groin are swollen and painful. The burning pain and profuse purulent discharge continue unabated for eight or ten days, and then the pain begins to be less severe, and micturition is not attended or followed by such intense suffering. Gradually the discharge becomes thinner and less in quantity, and in some instances it may become suddenly arrested.

A new train of symptoms now develop themselves: the swelling and irritation near the orifice of the urethra disappear, but the patient begins to feel an uneasy irritable condition in the perineum, and then a feeling of weight and itching about the anus and lower part of the rectum. At night the patient is often awoken by a painful erection of the penis, the organ is tense from engorgement, and curved downwards, constituting the condition termed *Chordee*. The erection evidently depends upon irritation of the prostatic portion of the urethra, the reflex effect being excitement and erection of the penis, which, in the inflamed state of the mucous membrane, gives rise to intense pain by stretching still further the swollen and inflamed membrane.

The pain on micturition is generally very slight after the first fifteen days, but the discharge may continue to be considerable in amount and of a purulent character for a much longer period. In some instances it seems to disappear, and then, without any obvious cause, to re-appear. This is most usually observed in persons of delicate or lymphatic temperament, or in those who have had gonorrhœa previously. In such cases the painful symptoms are less marked, but the progress of the disease is generally tedious, and most frequently terminates in gleet.

By the term GLEET, strictly applied, we mean a thin viscid and clear fluid discharge from the urethra; but the word is often made to include chronic thin purulent discharge in obstinate cases of gonorrhœa. There are few conditions more annoying to the patient and the surgeon than gleet. In many cases it baffles all our remedial measures, and often, when it has yielded to remedies, it re-appears whenever they are left off. Gleet seems to depend not only on the chronic inflammation of the mucous surface, but also apparently on an affection of the mucous follicles, increasing the discharge by over-secretion of thin mucus. Occasionally these follicles, or Cowper's glands, suppurate and give rise to troublesome complications, such as urinary fistula. In cases where the patient has previously suffered from attacks of gonorrhœa, when gleet is very obstinate, it is advisable to examine the urethra with a bougie, as not unfrequently the irritation causing gleet is kept up by the presence of a stricture.

When gonorrhœa is passing off it becomes retrocedent. The prostatic portion of the urethra sometimes becomes affected, and if the patient, thinking himself better, is imprudent, or so reckless as to indulge in any debauchery, acute abscess of the prostate may occur. This is attended with intense pain and weight in the perineum, congestion and protrusion of the mucous membrane of the rectum, like hæmorrhoids, and sometimes the serious mistake is made of treating the hæmorrhoidal swelling by ligature, as being the cause of the symptoms. More generally, as the discharge ceases, the patient becomes affected by swelling of the testicle—ORCHITIS, or HERNIA HUMORALIS. He complains of pain in the loins like lumbago, becomes feverish and nauseated, and the urine is scanty and high coloured. By and by pains of an acute character shoot along the inguinal canal, then intense pain is felt in the epididymis and spermatic cord, and the testicle becomes greatly swollen, tense, and painful. As the swelling

increases, acute oedema of the scrotum occurs, or more generally effusion of serum takes place into the tunica vaginalis, constituting acute hydrocele, and from the vessels thus relieving themselves the tension and pain in the testicle is diminished. When under treatment resolution is effected, the swelling, tension, and pain gradually disappear, and the symptomatic fever passes off. In most cases, however, hardness of the epididymis remains for a long time, and in some cases continues throughout after-life.

During the retrocedent stage of gonorrhœa, irritation of the bladder, of a very acute character, frequently supervenes, and is, I believe, often induced by the use of cubebs in large doses. There is considerable pain in the bladder, almost constant desire to pass urine, only very small quantities being passed at a time, with great straining and severe smarting pain at the neck of the bladder. If this condition be not soon relieved by appropriate treatment, spasm and engorgement of the textures at the neck of the bladder and around the urethra speedily lead to complete retention of urine, which, under the above-mentioned conditions, is attended with excessive suffering.

The *Treatment* of gonorrhœa depends on the stage of the disease when we first see the patient, and also on the state of the constitution. In the very early stage of gonorrhœa it has been proposed to cut short the disease by injecting a strong solution of nitrate of silver into the urethra. This is what is termed the *Ectrotic* or *Abortive* treatment. The latter term, in one sense, designates it best, for it almost invariably fails in effecting the purpose intended, and, from what I have seen of cases in which it has been tried, it frequently excites great irritation in the urethra, and leads to abscesses in the prostate, and lays the foundation of affections of the genito-urinary organs, which may ultimately destroy life by irritation and exhaustion.

My limits forbid me entering on a consideration of the many plans of treatment or remedies recommended in this disease, and I shall therefore state briefly the method which, from experience, I have found to be most generally suitable and efficacious.

In the very early stage, when the discharge is just beginning, the bowels should first be cleared out by some bland laxative, such as a dose of castor-oil, and then regulated by the use of bicarbonate of potash and rhubarb—drastic purgatives should never be given. The patient should be kept as quiet as circumstances will permit, and the diet should be light and unstimulating. Acetate or bromide of potash, in ten grain doses in camphor mixture, should be taken twice a day, and hyoscyamus may be added if the pain be severe. The parts should be kept very clean, and bathed with some mild alkaline solution. A weak injection of tannin, thrown into the urethra, may be used with advantage, but no stimulating injection should be used in this stage. The patient should drink freely of thin barley water or linseed tea, or the old-fashioned but useful remedy, five grain doses of nitrate of potash, combined with powder of gum arabic, dissolved in water. If he wishes to avoid taking such remedies lest he incur suspicion, he may drink aerated potash, or Seltzer waters.

After the discharge has become thick and mucopurulent, we may begin the use of the specific remedies, such as cubebs or balsam of copaiva. In my own practice I generally begin by exhibiting the balsam of copaiva in doses of fifteen drops, thrice a day, either by itself or in the form of emulsion, combined with tincture of hyoscyamus, liquor potassæ, and some mucilage. Afterwards the dose of the balsam may be increased, or it may be combined with cubebs and henbane into a paste, of which the patient takes a bolus thrice daily. In cases where the discharge continues longer than usual, or where the patient has had previous attacks, a grain or two of tannin or powdered alum may be added to each dose of the paste. As to local applications, at first acetate of lead lotion may be applied to bathe the glans penis, and to the inflamed orifice of the urethra, and subsequently, in weak solution with acetate of morphia, it may be injected into the passage. In using this, or any other form of injection, the canal should first be washed out by injecting tepid water. Should pain and swelling of the inguinal glands occur, rest is absolutely necessary, together with the local application of acetate of lead lotion to the swollen glands. My experience is that suppuration rarely occurs in such swollen glands in gonorrhœa, but these precautions are requisite to prevent the risk. If chordee supervene, the use of an opiate suppository at bedtime, or an enema of iced water, and a camphor and hyoscyamus pill, or a full dose of bromide of potash at night, are the best means of preventing this painful symptom. When an attack does occur, plunging the organ into cold water is the best means of affording temporary relief.

When, during the retrocedent stage, symptoms of prostatitis and irritable bladder supervene, the use of cubebs and the balsamic remedies should be left off, and the bromide of potash, or camphor and henbane substituted. The patient should drink freely of diluents; and after the bowels have been cleared out by a dose of castor-oil, an opiate enema, or suppository, should be administered. If the patient be young and robust, and the symptoms acute, great relief will be experienced from the application of leeches to the verge of the anus. Of course, under these circumstances, the most absolute rest is necessary.

The most troublesome stage, or rather consequence of gonorrhœa, is the chronic form of discharge termed gleet. It often baffles all remedies for a time, and runs its own course in spite of them. This condition is, I believe, most likely to be prevented by commencing the use of astringent and slightly stimulating injections when the discharge of gonorrhœa becomes thin, and the pain in micturition has nearly disappeared, and it is at this stage that I think the use of cubebs in moderate doses, along with eight or ten drops of the muriated tincture of iron, diffused in a large proportion of water, is most beneficial. At the same time the strictly antiphlogistic regimen necessary in the acute stages of gonorrhœa should be relaxed, and some wine allowed, at first in small quantity, but gradually increased unless it re-excites the pain. When gleet is fairly established, the remedies, local or constitutional, most generally useful, are those of a tonic or stimulating character. Internally, the use of cubebs and iron, or of sulphate of zinc in doses of one or two grains twice a day, combined with Chian turpentine, and

extract of gentian, are what I find most serviceable. In some patients I have found sulphate of quinine act beneficially. Zinc and alum injections, and occasionally passing a bougie, are the local remedies in which I have the most confidence.

Gonorrhœa in the female differs in some respects from the disease in the male, both in regard to its symptoms and treatment. In the female the disease may be, and often is, confined to the vagina, and as that passage has no necessary connection with the urethra, the symptoms are often only heat and pain in the vagina, and swelling of the vulva, followed by the purulent discharge, and unless the urethra becomes affected there is no heat or pain in micturition nor any other affection of the urinary organs. When these organs, however, do become affected, then of course all the symptoms of urethral inflammation occur, as in the male, and are even intensified. The conditions just alluded to modify the treatment. In vaginal gonorrhœa the treatment is almost entirely local, and consists in washing out the passage with mild alkaline lotions, and then injecting solution of acetate of lead and opium, and applying lint soaked in the solution to the vulva, and when the more acute symptoms pass off, using zinc and alum injections to arrest the discharge. Remedies such as balsam of copaiva or cubeb pepper, which are considered specifics in the male, exert no influence in the cure, as they act on the urinary organs, and do not affect the vagina. But they are required if the urethra becomes affected.

In speaking of the general characters of gonorrhœa virulenta, I mentioned the secondary constitutional affections which often follow it—the lichenous eruptions and rheumatic symptoms. When these supervene we should leave off the balsamic remedies and cubebs, and have recourse to small doses of the nitrate of potash, colchicum wine, and diaphoretics, and the occasional use of the alkaline warm bath, or the vapour bath in bed may be substituted, to avoid the risk of the patient being chilled after the bath. As the more acute symptoms pass off, the iodide of potassium may be given with advantage.

One of the most serious affections following gonorrhœa is gonorrhœal ophthalmia. It may arise from the patient inadvertently touching the eye with the gonorrhœal discharge; but it arises as a constitutional affection independently of such cause. The disease is characterised by extreme vascular congestion, and bright redness of the conjunctiva, the sub-conjunctival cellular tissue becomes infiltrated and swollen, leading rapidly to chemosis, infiltration, and swelling of the eyelids and purulent discharge. The cornea is very liable to suffer at an early period owing to the pressure and interference with its nutrition. It becomes opaque from effusion between its layers, and ulceration or sloughing may result. The treatment requires to be very active. The chemosed conjunctiva should be snipped to allow the infiltration to escape, and to relieve the congested vessels; the swollen conjunctiva of the eyelids should be snipped or scarified for the same purpose, and the conjunctival surface painted over with a solution of nitrate of silver, or a strong solution of alum; leeches should be applied to the temples, and a blister behind the ear, and strict antiphlogistic regimen enforced. In milder forms, the solution of nitrate of silver or alum to the conjunctiva to

arrest the purulent discharge, combined with the use of saline purgatives, is in general sufficient to relieve it. When the sclerotic coat of the eye or the iris becomes affected, the use of calomel and opium, and the local application of belladonna or atropine, must be used in addition to antiphlogistic remedies, on the general principles of treating scleratitis and iritis.

The irritation caused by the gonorrhœal discharge sometimes leads to the formation of warts on the prepuce and glans penis. I believe that attention to cleanliness, and washing the parts frequently with some mild alkaline lotion, will do much to prevent such formations. They occur, indeed, in their most exaggerated form in females, in whom, from the constant discharge lodging on the nymphæ and vulva, and passing back from the vagina, we frequently find enormous masses of warts occupying the perineum and around the orifice of the anus. In the early stage of these warty excrescences the application of nitrate of silver, strong acetic or chromic acid, is sufficient to destroy them, and if alkaline lotions be subsequently used, their extension will be prevented. When large, pendulous, and prominent, they must be clipped off, and the cut surface and any incipient vegetations touched with nitrate of silver.

We occasionally meet with a discharge of purulent matter from the lining membrane of the prepuce and the surface of the glans penis—GONORRHOEA PRÆPUTIALIS. The prepuce is swollen, cedematous, and painful, and the discharge is of a greenish-yellow colour, and has a peculiarly offensive odour. The sebaceous secretion seems to be altered in character, and increased. There is no pain on micturition, but considerable tenderness of the glans penis. The treatment required is purely local. Alkaline washes should be injected between the glans and prepuce, or, if the latter can be drawn back, applied directly to the parts. The affected surfaces should then be painted over with a solution of nitrate of silver. These measures generally serve to arrest the discharge and effect a cure; or if the discharge continues it is less offensive, and the use of sulphate of zinc and alum lotion is sufficient to complete the cure. In cases where the prepuce is inflamed, swollen, and cedematous, the acetate of lead and opium lotions should be applied to the part to allay the swelling, and the alkaline and astringent lotions injected beneath the prepuce to arrest the discharge. Beyond antiphlogistic regimen, no constitutional treatment is required.

LECTURE CXVII.

PHYMOSIS AND PARAPHYMOSIS : Treatment—Orchitis or Inflamed Testicle : Treatment—Hydrocele : Diagnosis and Treatment ; Operation—Hæmatocele : Difficulties in Diagnosis : Treatment—Circumcision and Varicocele ; Diagnosis and Treatment—Tumours of Testicle—Castration : Steps of the Operation and points to be specially attended to.

DURING the progress of gonorrhœa the irritation caused by the disease may induce the affections of the prepuce, termed phymosis and paraphymosis ; but as these conditions arise also from other causes, we may as well consider them in their general character.

The condition termed **PHYMOSIS** consists in the prepuce being elongated, closing in the glans penis, its orifice being contracted and thickened, so that it cannot be drawn back to uncover the glans. Phymosis frequently occurs in children as a congenital condition, and is, except under some accidental circumstances, unattended by swelling or inflammation. But when it supervenes on gonorrhœa or syphilis, the prepuce is swollen, hard, and its margin slightly oedematous. In such circumstances, by the use of acetate of lead lotion, and injecting tepid water beneath the prepuce, the swelling diminishes, and

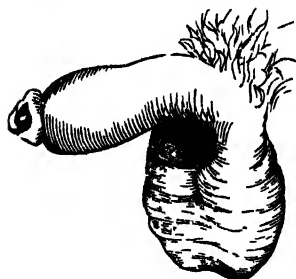


Fig 232

the glans penis can be exposed. If this condition, however, has been permitted to exist till consolidation of the inflammatory swelling has taken place, the discharge is apt to collect beneath the prepuce, and give rise to abrasion of the opposed surfaces, and partial adhesion may take place between the glans and lining membrane of the prepuce, or the foreskin may ulcerate or slough. When we are called to a patient under such circumstances, we must slit up the foreskin to such an extent as to be able to uncover the glans. To effect this we take an ordinary director, pass it between the glans and prepuce as far up as the reflection of the lining membrane, bring the director close to the side of the frænum, then carry a sharp-pointed, curved bistoury along its groove, transfix the skin at the point of reflection, and slit the prepuce freely open. In many cases, when this is done, it will be found advantageous to clip off the thickened and altered foreskin, so as to

effect complete circumcision. A few stitches may require to be inserted to diminish the cut surface.

In cases of congenital phymosis, circumcision should always be performed. This is sometimes done by pressing back the glans penis and then seizing the anterior part of the foreskin between the blades of a pair of dressing forceps, and clipping off the projecting part of the prepuce; but this method is very imperfect, the skin and lining membrane of the prepuce are very loosely connected, and the latter is closely applied, almost adherent to the surface of the glans; hence, when the projecting portion of the foreskin is cut off, you must slit up the lining membrane, and cut it off subsequently. It is better to proceed in the manner described in the case of acute phymosis; that is, to slit up the prepuce to the point of reflection, and then clip it off with scissors. In this case, however, we must recollect that it is essential to stitch the cut edges of the skin and lining membrane, to prevent their separation. Ice or iced-water dressing should be applied to prevent oozing, and the cut margins of the prepuce protected by the application of a little oil when the patient passes water.

PARAPHYMOSIS consists in retraction of the prepuce, which becomes swollen. The sharp and unyielding cutaneous margin becomes tight, and constricts the penis behind the glans. The mucous lining is swollen and œdematous, in consequence of infiltration of the loose sub-mucous tissue. When we examine the part we find two swellings with a deep narrow sulcus between them. In front there is the swelling caused by the mucous lining of the prepuce and the glans penis; posteriorly, the swollen and inflamed integument of the prepuce; and on separating the swellings we perceive at the bottom of the intervening sulcus the tight constriction caused by the unyielding margin of the prepuce. In the treatment of paraphymosis we must remember that, unless the condition be relieved, strangulation of the constricted parts will be the result, and sloughing not only of the prepuce, but even of the glans penis, may occur. We must therefore be prompt in our measures of relief. If called to the patient in the early stage, by puncturing the œdematous swelling in front, and by compressing the glans penis with one hand whilst we draw forward the prepuce with the other, we often succeed in removing the malposition of parts. But if there be any difficulty, the operation required for paraphymosis is so simple and so slight that we should have recourse to it at once. The operation consists in separating the two swellings, so as to expose the constriction at the bottom of the sulcus, and then with the point of a tenotomy knife or narrow bistoury notching the constricting ring deeply at two or three points of its circumference; this at once relieves the constriction, and the prepuce is easily replaced, and when this is accomplished, the marks of the knife can scarcely be perceived. The so-called operation is really less painful and less likely to injure the

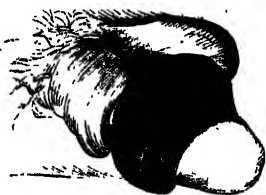


Fig. 233.

parts than attempts at reduction by pulling forcibly on the prepuce. Cold-water dressing, to allay excited action, is all the after-treatment which is required.

INFLAMMATORY SWELLING OF THE TESTICLE—Orchitis, or *Hernia Humoralis*, as it is sometimes termed, arises from various causes, but perhaps most frequently as a result of retrocedent gonorrhœa. I have already described the mode of invasion and character of its symptoms

when it results from gonorrhœa, and as these are the same from whatever cause the disease arises, I need not repeat them here, but shall simply state the treatment most suitable for its cure.

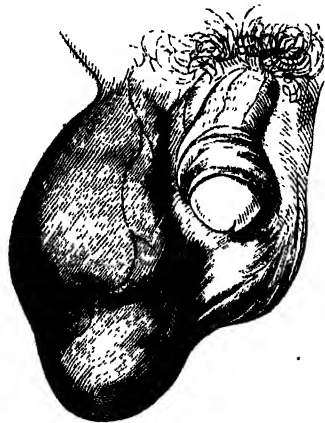


Fig. 234.

The plan of treatment most generally useful is to deplete at the first by opening one or two of the small scrotal veins, and by immersing the testicle in moderately warm water to encourage the bleeding, which is afterwards arrested by a bit of adhesive plaster, and the patient is made to remain in the recumbent posture, with the scrotum supported by a handkerchief sling, or on a cushion, while lint dipped in slightly tepid anodyne lead lotion is applied over it. The bowels should

be kept gently open, and the diet should be strictly antiphlogistic. If the disease occur during retrocedent gonorrhœa, all specific remedies should be abandoned, and bromide of potassium with camphor mixture, aerated potash water, and other diluents substituted for them.

In many cases effusion takes place into the tunica vaginalis, constituting acute hydrocele, and great relief is given by puncturing the distended sac, and so relieving tension. In some cases I have made small incisions into the swollen testis, with great relief and without any bad after-effects; but I have not carried out the practice, as I am impressed with the belief that the risk of exciting irritation more than counterbalances the relief which the incisions afford at the time. In many instances, if we see the case at the commencement, compression of the testicle by methodical application of adhesive strapping will often prevent the accession of swelling, and cure the disease; and in all cases the strapping, applied after the painful symptoms are subdued, is useful in obtaining the speedy absorption of interstitial exudation, and so preventing permanent organic change in the gland or epididymis; and for the same purpose I think it is generally advisable to give a few doses of gray powder, or one-grain pills of the green iodide of mercury, during the progress of the treatment. If any hardness of the epididymis continues, a little iodine or camphor and mercurial liniment may be applied, rubbed in over the swelling.

HYDROCELE OF THE TUNICA VAGINALIS consists of a collection of

serous fluid within the cavity of that sac. The scrotum gradually becomes distended, and the swelling passes up in front of the spermatic cord towards the external abdominal ring. The collection of fluid forms a tumour, generally of a pyriform shape, perfectly smooth on the surface, and unattended by any painful symptoms, except the dragging sensation caused by its weight and bulk. The history of the disease is that of slow gradual increase from below upwards. The testicle can be felt at first at the posterior part of the swelling, but its relation is lost as the fluid collects and overlaps it.

The disease may follow some injury or irritation of the genito-urinary organs; but for the most part no distinct cause can be assigned for its origin. It is a disease of common occurrence in all countries, but is especially frequent in warm climates. The diagnostics of hydrocele are—its form, and the manner in which the swelling takes place, its weight as compared with solid tumours, the feeling of tense fluctuation, and the transparency of the swelling when we examine it by transmitted light, by which last test we at once satisfy ourselves of the nature of the contents of the swelling, and see the relative position of the cord and testicle.

When speaking of the diagnosis of scrotal hernia, I have already fully described the differential diagnosis of these two diseases, and need not repeat it here. It may, however, be mistaken for other tumours of the scrotum, or other swellings may be mistaken for it, more especially medullary tumours, which have a feeling of elasticity not unlike fluctuation. Such tumours, of course, are not transparent when the light test is used; but then, in some instances, hydrocele, owing to the density of the tunica vaginalis, is also opaque; and unless care be taken, in applying the light test, to keep the ulnar side of the hand closely applied to the scrotum, the reflected light of the taper on the convex surface of the swelling may be mistaken for transparency. As a general rule, however, the diagnosis is not difficult, if we take all the circumstances of the case into account. In young children, and even in adults, when the hydrocele passes high in front of the cord, it is advisable to place the patient recumbent, and try whether the fluid can be pressed back into the abdomen, as it occasionally happens that a narrow canal of communication with the peritoneal sac continues narrow; and this would modify our method of treatment.

The fluid in hydrocele is of a pale straw colour, and frequently we observe sparkling or oily-looking particles floating in it; this is cholesteroline. In some cases having all the ordinary symptoms of hydrocele, the fluid drawn off is colourless or slightly opalescent, and on examination with the microscope we find spermatozoa in it. This constitutes what is termed *Spermatocele*. In its general symptoms it in no respect differs from hydrocele, except that it seldom attains so large a size, and the treatment is the same in both forms of disease.

The Treatment is either palliative or radical. The former consists in tapping the distended sac with a trocar and canula, and drawing off the fluid from time to time, so as to alleviate the dragging and uneasy feelings produced by the swelling. This is done in cases where, from the state of the testicle, or owing to a communication with the peri-

toneal sac still remaining open, the radical cure is unadvisable. The radical cure is best effected by tapping the sac, as in the palliative method, and, when all the serous fluid is evacuated, injecting two or three drachms of strong tincture of iodine, shaking the scrotum so as to bring the iodine in contact with all parts of the affected serous surface to create excited action. The part becomes in some hours as much swollen as before the procedure, but the swelling is inflammatory, and a change of action in the serous sac is induced, which prevents re-accumulation of the fluid. It was formerly supposed that adhesive inflammation and obliteration of the sac followed the injection of irritating fluids; but where opportunities have occurred of examining the parts in patients who had undergone the operation, adhesions of the opposed serous surfaces have seldom been found to be extensive, and frequently none exist, so that we must account for the cure by supposing some change of action to be induced by the stimulation of the membranes. In cases where the ordinary method fails, which it does occasionally, then we must resort to the old operation of laying open the sac freely, removing a portion of it, and dressing the exposed surface with slips of lint soaked in some stimulating lotion, and allowing the remains of the sac to granulate and consolidate.

The *Operation* for the cure of hydrocele is very simple. The instruments required are a small trocar and canula, and a small graduated glass syringe, with a brass nozzle to fit the canula, for the purpose of



Fig. 235.



Fig. 236.

injecting the tincture of iodine. The scrotum is kept tense, and the position of the testicle ascertained. The surgeon then plunges the trocar perpendicularly (a) through the scrotal coverings at the most prominent part, till he feels it enter the sac, then he changes its direction and makes it pass obliquely upwards to avoid injuring the testicle (b, figs. 235 and 236). When the sac is fairly emptied of fluid the iodine is injected, and the syringe and canula withdrawn at the same

time. The patient should then be placed in bed, with the scrotum supported. Should the inflammatory swelling be slow of disappearing, stimulant evaporating lotions should be applied to hasten its discussion.

HÆMATOCELE, as the name implies, is a collection of blood or bloody fluid. It may arise from an injury rupturing or penetrating the tunica vaginalis, and blood distending its cavity; but true hæmatocele in the scrotum generally results from slow changes taking place in a hydrocele. The tunica vaginalis becomes remarkably altered in structure, greatly thickened, and of fibrous or even fibro-cartilaginous consistence, and occasionally loaded with earthy deposit, or ossified, as it is termed. The internal surface is also altered, congested, and flocculent; and, in general, a mass of fibrine or decolourised clot is found at the lower part of the cavity. The fluid contents, in case of true chronic hæmatocele, are usually of a dark brown colour, like porter, and, as in the case of hydrocele, cholestrine is usually found in the fluid. The diagnosis of hæmatocele is not so easy as that of hydrocele, for in hæmatocele we have no translucency, whilst the weight, and the doughy or even hard feeling, communicated by the coagulum which forms part of its contents, render the distinction between it and tumours of the testicle more difficult. We must trust, therefore, more to the history of the case and the general aspect of the patient than to the local conditions by themselves to guide us aright. Fortunately the treatment which requires to be adopted in hæmatocele enables us to make sure of the true nature of the disease; and should the swelling prove to be a tumour of a more serious character, we can then proceed to remove it at once.

The *Treatment* of hæmatocele consists in making a free incision into the tunica vaginalis, evacuating its contents, and then removing as much of the anterior and lateral walls of the sac as we can without injury to the testis and cord; and if the scrotum is much distended a portion of it may also be removed with advantage. After all bleeding vessels have been secured, the surface of the portion of the sac which has been left is brushed over with a solution of perchloride of iron or spirit of turpentine, and slips of lint or charpie soaked in carbolised oil laid lightly in the cavity. Subsequently, as suppuration and granulation proceed, the dressings must be conducted on the general principles applicable to all granulating surfaces. In those cases where the tunica vaginalis is ossified or cartilaginous, the testicle is compressed and atrophied, and so connected with the altered texture that its function is destroyed. In such cases the best plan of treatment is to remove the whole mass, along with a portion of the scrotum by castration. In cases where a large part of the contents of the sac is fluid, you might be tempted to draw it off, but such a procedure is almost invariably followed by decomposition and putrescence of the remaining semi-solid contents of the sac, exhalation of foetid gases, and formation of purulent matter, the presence and confinement of which give rise to intense irritative fever. When such practice has been adopted and these conditions supervene, no time should be lost in laying the cavity freely

open, washing it out with Condy's fluid, and subsequently with carbolic lotion, and applying charcoal poultices over the parts; at the same time using the general treatment necessary to allay the constitutional irritation.

The disease termed CIRSOCELE is varix of the spermatic veins. VARICOCELE is also sometimes used to denote that condition, as well as a general varicose state of the scrotal veins. There should seldom be any difficulty in arriving at a correct diagnosis of this affection. The tortuous distorted veins, and their relation to the cord and testicle, are in general sufficiently obvious, whilst the feeling they communicate to the fingers when grasped, and impulse given to the blood contained in them when the patient coughs, are so peculiar as scarcely to be mistaken. I have already discussed the diagnosis between this disease and scrotal hernia, and pointed out that the diagnostic chiefly to be trusted is, that if, after reduction of the swelling, when the patient is recumbent, pressure be made over the inguinal ring, and he then assumes the erect position, in the case of a cirsocele the varicose veins will rapidly become tense, whilst a hernia would be retained by the pressure of the fingers. Cirsocele is generally met with in young men, and frequently causes great mental anxiety and depression, in consequence of the idea that it may lead to impotence. It is possible that very great distension of the veins, long continued, may give rise to conditions leading to atrophy of the gland; but though the disease is very common, such a result is so rare as scarcely to be considered as a probable one; and, moreover, we not unfrequently find that without any treatment the condition passes off as a patient grows up. In many cases, by allaying sources of irritation in the genital organs, we effect a gradual cure with scarcely any local treatment. As a general rule, I am very averse to advise any treatment beyond cold bathing to the genital organs, and the use of a light suspensory bandage; but in some cases, where the enlargement of veins was very great, and gave rise to great pain in the testicle, I have used acupressure to the veins principally affected, with advantage, and in several complete cure has followed. In other cases, where the skin of the scrotum was much relaxed, I have removed a portion of the scrotal integuments, and the subsequent contraction has afforded considerable relief, although in some instances only for a time. The class of cases to which the back lever vein truss is applicable are those where, from some obstruction to the venous circulation within the abdomen, the column of blood from above presses down upon and distends the veins of the cord and scrotum; and the action of the truss is intended not to interrupt but to modify the circulation. A strong suspensory bandage should always be worn at the same time. In ordinary cases of cirsocele the truss would be hurtful. Whilst I mention the treatment which some special cases may require, I repeat that in the great majority of cases of cirsocele all that is generally required or warrantable is to use means to allay all sources of excitement and any irritation in the urethra; to use cold bathing to the genital organs morning and evening; and to support the scrotum by a well-made suspensory bandage.

The TESTICLE is frequently the subject of tumour-growth, both of the simple and malignant forms. Unfortunately the latter are the most common. The simple growths affecting the testis are — *simple sarcoma*, *fibrous* and *fibro-cystic* tumours. The malignant are generally of the medullary form, either ordinary *cerebriform* or *vascular medullary sarcoma*, *fungus hæmatodes*, and spindle-cell sarcoma. *Scirrhus*, so common in the female breast, is exceedingly rare in the testicle.

These diseased conditions of the testicle are distinguished by the same general vital manifestations and local appearances which I described when speaking of tumour growth; and by attending to these we are able to diagnose the nature of each case, and to adopt the appropriate treatment. To describe each different form of tumour of the testicle would be to repeat what has already been discussed in the earlier part of the course. In all true tumours of the testicle, whether simple or malignant, removal of the tumour by castration is necessitated. In the case of malignant growths we must make sure that the cord is healthy at a point where we can divide it, and that the inguinal glands are not affected by the disease.

If there be nothing to contra-indicate the operation, CASTRATION is performed as follows:—The groin and scrotum having been previously shaved, the operator grasps and slightly raises the diseased testicle with his left hand, and renders tense its scrotal coverings. He then commences his incision through the integuments over the cord, a little above the external abdominal ring, and carries it down to the upper part of the tumour, where he makes it diverge first to one side and then to the other, so as to mark out for removal a large elliptical portion of the scrotal integuments. These incisions should be carried deeply through the coverings to the tumour. The surgeon next clears the cord at the upper part of his incision, cuts through the fibres of the cremaster, and separates the cord thoroughly, so that his assistant can grasp it firmly between his finger and thumb, above the point where it is to be divided. By taking these precautions there is no fear of the cord being retracted or slipping. Of late I have in several instances secured the vessels of the cord, and prevented retraction, by passing an acupressure needle beneath the vessels, and compressing them with the wire loop. When the cord is thus secured, the operator divides it, and then, unless any unusual adhesions exist, the testicle, along with the elliptical portion of integument marked out by the incisions, is turned out by a few touches of the knife; indeed, the loose connections of the tumour to the scrotum scarcely require the use of the knife after division of the cord. To commence by dissecting the testicle from the scrotum before dividing the cord is to prolong the operation unnecessarily.

If acupressure of the cord has been adopted, then the only vessels which require ligature will be the large branch of the inguino-pudic artery, which will be readily found at the upper and outer part of the scrotal incision, and the numerous scrotal twigs of the superficial perineal artery at the lower part of the scrotum. The parts should be thoroughly cleansed by pouring first tepid and then cold water over

the open wound, which should afterwards be brushed over with solution of chloride of zinc, or spirit of turpentine, to arrest all oozing, and act as an antiseptic. The margins are united by points of suture, the lowest sutures being left untwisted for a few hours to allow any oozing of blood to escape. The patient is then placed in bed, with the thighs slightly separated, and the scrotum supported on a pillow formed of tow or oakum, covered with gutta-percha tissue. A piece of gutta-percha tissue is also laid over the wound, and an ice-bag applied over it, and frequently changed. This application of dry cold is use in all cases of excision of tumours, and find that it obviates oozing of blood, and keeps the local action within due bounds. Its effects must of course be watched, for in some instances it may prove too depressing, and interfere with union.

Removal of a very large tumour of the testicle can be effected easily by a single longitudinal incision of the scrotum ; but it is always, I think, advisable to remove a very considerable portion of integument, to diminish the cut surface left, the number of vessels requiring to be secured, and the risk of reactionary oozing of blood, whilst the removal of the loose skin also facilitates primary union.

Besides tumours of the testicle, properly so called, we meet frequently with simple chronic enlargement of the gland, which in general yields more or less readily to strapping with adhesive plaster, or friction with mercurial and camphor liniment, or iodine liniment, combined with the use of internal deobstruent medicines, such as iodine, or a mild course of mercury. In some instances the swelling is obstinate, and proves a source of annoyance to the patient, and then castration may be warrantable, but not until a fair trial has been given to other means.

LECTURE CXVIII.

SYPHILITIC HYDRO-SARCOCELE : Dangers of Operation in such Cases—Scrofulous Testicle—Sinuses and Abscesses—Fungoid Scrofulous Testicle: its True Nature: Methods of Treatment—Irritable or Neuralgic Testicle—Elephantiasis Scroti: Operations for it. Removal—Soot-Wart, or Chimney-Sweep's Cancer: Treatment—Epithelioma of Prepuce and Penis—Amputation of the Penis—Diseases of Genito-Urinary Organs in the Female—Ovarian Disease—Ovariectomy—Vesico Vaginal Fistula, and Operation for its Cure—Suture of the Female Perineum.

IN cases of patients affected with tertiary syphilis, we not unfrequently meet with a hard, indolent enlargement of the testicle, combined with hydrocele—**SYPHILITIC HYDRO-SARCOCELE.** This condition is one in which you must be very cautious in having recourse to removal of the testicle, when the disease occurs in a cachectic person, or one past middle life. In such cases I have seen a low unhealthy form of gangrenous erysipelas attack the wound, and diffuse infiltration take place along the cord, and lead to fatal results. Puncture of the hydrocele and injection with iodine do good, if assisted by internal remedies, but removal of the testicle in a marked cachectic state of the constitution I consider to be hardly warrantable.

In scrofulous patients subacute orchitis frequently terminates in suppuration in the substance of the gland, and gives rise either to extensive sinuses and small suppurating cavities in the gland, or to a larger ulceration of the tunica albuginea and scrotal coverings at some point, followed by the protrusion of a fungus of very formidable appearance. This latter condition is termed the **SCROFULOUS FUNGOID TESTICLE.**

At one time the fungoid testicle was looked upon as a malignant disease, and castration was resorted to for its removal. Sir William Lawrence pointed out that the disease was quite different in character from malignant fungus, and that by shaving off the more prominent part, and applying some mild escharotic or stimulant astringent wash, the skin would heal over it, and that, therefore, castration was not required. Following out a suggestion of Professor Goodsir's, who found that the protruded part contained the healthy tubular structure, merely separated by interstitial deposit of lymph, the late Professor Syme proposed to save the protrusion by dissecting the surrounding integuments of the scrotum, and bringing them over the fungus. The pressure of the integuments, and the excitement following the operation, led to gradual absorption of the interstitial deposit, and the gland was thus

saved. I have frequently performed this operation, and always with success, so far as repression of the fungus was concerned; but in several cases the gland saved soon became so atrophied that I should doubt if its functions were retained. Still, in many instances, it does succeed perfectly, and is in all cases preferable to castration. But in some rare cases where the patient is very weak, or where there is a syphilitic taint, hereditary or acquired, I would advise the method proposed by Sir William Lawrence as preferable to the more severe operation, as in such circumstances the dissected scrotal integument is apt to be affected by unhealthy action, instead of uniting over the protrusion.

The treatment of sinuses in the substance of the testis resulting from an unhealthy form of suppuration consists in dilating their external orifices freely, and injecting a little tincture of iodine along their track, and then compressing the testicle by adhesive strapping. In cases where this fails to effect its object we must fairly slit up the sinuses and treat them as ordinary sinuses. When the gland is traversed by sinuses in all directions, with small depots of unhealthy pus in its substance, the function of the organ is destroyed, and the least painful and most effectual treatment is removal, and this should be done before the gland becomes largely adherent to the scrotum, as the operation then becomes much more difficult and tedious.

NEURALGIA OF THE TESTICLE, or IRRITABLE TESTICLE, is an excessively painful affection, but scarcely admits of surgical treatment. Castration has occasionally been had recourse to as a last resource, when the intensity of the suffering was unbearable, but the remedy is hardly warrantable, for the relief is only temporary. The divided cord becomes the seat of neuralgic pains, or the opposite testicle is soon affected; and in some few cases, where the painful symptoms were cured, the patients, forgetting their former sufferings, have blamed the surgeon for yielding to their importunities for relief by removing the testicle. The remedies most generally used as palliatives are the application of blisters over the lumbo-sacral region, the cold douche to the spine, and cold baths to the genital organs, together with proper constitutional treatment by means of chalybeates and quinine, and taking great care to prevent accumulation of feculent matter in the large intestine. In some cases marked benefit follows the use of Lallemand's cautery applied to the prostatic portion of the urethra.

HYPERTROPHY, or ELEPHANTIASIS OF THE SCROTUM, though of rare occurrence in this country, is occasionally met with, and in warm climates the affection is not uncommon. The whole integuments of the scrotum are swollen, thickened, and altered in structure, so as to form an enormous tumour, in which the penis and testicles are deeply embedded, the integuments of the prepuce, hypertrophied and covered with indurated excrescences, alone remaining visible, as shown in the woodcut on the following page.

In such cases the only remedy is removal of the whole tumour, which, as it is a simple hypertrophy, has no tendency to return. Such operations are attended with great risk from the immediate loss of

blood, and therefore, except when the tumour is comparatively small, it is scarcely admissible to attempt any dissection for the purpose of saving the genital organs, but to proceed more summarily to complete ablation of the mass by a stroke of the long amputating knife. To obviate or diminish hæmorrhage during the section, the method usually adopted is to suspend the tumour above the height of the body for some time before the operation, so as to empty the large veins, and then the direct control of the hæmorrhage during the operation is best effected by the plan recommended by Professor Fayrer of Calcutta—namely, to carry a stout cord round the neck of the mass, and both ends having been passed through a strong steel ring about the size of a small curtain ring, strangulation of the pedicle is effected by two assistants drawing on the ends of the cord in opposite directions. Or a large stout needle in a fixed handle, and blunt except at the point, and with an eye near the point of sufficient size to admit a strong whip-cord, may be thrust through the narrowest part or neck of the tumour. The cord is thus carried through, the loop divided, and each half used to strangle the firmly one division of the neck of the growth, which is then cut off by the amputating knife. When the mass is removed the open mouths of the vessels in the pedicle may either be secured separately, and the compressing cord removed, or if there be only slight oozing from the pedicle, the cords may be tied firmly and allowed to remain as ligatures. In the latter case care must be taken to ensure freedom of the orifice of the urethra. In cases where the tumour of the scrotum is of moderate size, and the integuments sufficiently soft to enable us to recognise the position of the testicles and penis, by careful dissection at the upper part of the swelling we may clear and insulate these organs so as to save them and a portion of integument, but even when the skin is so affected as to enable us to save but little, if any, it is wonderful how these organs become covered in by borrowing from the loose integuments of the abdomen and perineum.



Fig. 237.

Delpêche, in his *Clinique Chirurgicale*, has given the details of a case of elephantiasis of the scrotum in which, by planning his incisions, he obtained a covering for the parts at the time he removed the tumour; but in such prolonged and complicated dissections amongst hypertrophied and vascular tissues, the risk of the patient sinking from

loss of blood is so great that it is better to take the more rapid methods of procedure. Before proceeding to the removal of the diseased mass, careful examination should be made to ascertain that there is no hernial protrusion on either side, as that condition has been found present, and if it be, the steps of the operation must be conducted with great care, and in some cases a large scrotal hernia might contra-indicate the operation.

The scrotal integuments are sometimes attacked by epithelial cancer. The parts present the usual appearances of that disease, and must be removed by the knife before the neighbouring lymphatic glands become affected. In operating, the integuments should be removed wide of the diseased part, and very little anxiety need be experienced as to there being sufficient covering left. In one case I removed almost the whole of the scrotal integuments, so that at the time it was impossible to cover in the testicles, yet in less than six weeks the wound was completely cicatrised without any apparent deformity; at all events, we must remove the disease thoroughly if we interfere at all.

There is a peculiar form of epithelial cancer of the scrotum in which the disease seems to arise from the effects of a direct local irritant. I allude to what is termed CHIMNEY-SWEEPERS' CANCER, or SOOT-WART. It is said by some that this is a peculiarly malignant form of disease, and it is quite true that if it be allowed to go on until the inguinal glands become affected and ulcerated, and till the ulceration

extends to the abdominal parietes, the local irritation soon destroys the patient. But from what I have seen of the disease, I believe that, like most canceroid affections arising distinctly from a local cause, if it be removed early there is not much tendency to recurrence, if the original exciting causes be guarded against; and I have seen enlarged glands disappear after the removal of the diseased integuments, showing that they had merely been affected sympathetically. It is, however, quite possible that this affection may be excited in a person of cancerous diathesis, and then,



Fig. 238.

of course, the progress of the case will be very different. The accompanying figure (No. 238), represents the disease in its latter stage, when the ulceration has destroyed the scrotum and exposed and affected the testicle.

Whatever difference of opinion may exist as to the extreme malignancy of the disease, there is none as to the treatment. Early and complete removal of the diseased part of the scrotum is clearly indicated.

When ulceration has taken place, and extended or is extending towards the groin, the free application of chloride of zinc is the most efficacious remedy if the parts cannot be excised. For my own part, even in cases such as that represented in fig. 238, I would advise

excision of all the fungating margins and surrounding skin, and removal of the testis if affected, before applying the chloride of zinc, rather than trust to that remedy alone. I would do so even although there were enlarged glands in the groin; and from what I have seen I would not despair of success in arresting the ulceration, for I have great belief in the doctrine that cancrroid disease, arising from a local cause, is seldom truly malignant as regards the constitution; and, at all events, by such procedure as I advise, we can hardly make matters worse, whilst we give a chance of relief, if not of absolute cure. When ulceration attacks the textures in the groin we often find the common femoral artery and vein laid bare, and death may occur from hæmorrhage caused by the ulceration of these vessels.

Epithelial cancer frequently attacks the prepuce, and may involve the glans penis and body of that organ, so as to necessitate amputation. The disease is very liable to arise in persons who are the subjects of congenital phymosis, as the lodgment of the sebaceous secretion between the prepuce and glans leads to attacks of irritation from time to time, and as the patients advance in life cancrroid disease supervenes. If the disease is limited to the prepuce, free circumcision is all that is requisite; but if the glans penis be affected, then the removal of the penis wide of the diseased part is imperative. In many cases the warty induration of the prepuce renders it difficult to ascertain the extent of the disease, and hence it is generally advisable to slit up the prepuce to make quite sure whether or no the glans penis be involved in the diseased action. Like cancrroid affections of the lip and scrotum, there seems to be different degrees of malignancy in different cases. In some the disease appears to be entirely local, and shows no tendency to return, whilst in others it affects the lymphatic glands and the general system, and returns rapidly. I know of cases in which, more than seventeen years ago, I removed the penis for cancrroid disease of very unfavourable appearance; the patients are still in excellent health, and without the slightest tendency to recurrence of the affection, whilst in other cases I have known it recur in less than twelve months, and lead to cancerous tumours of the inguinal glands.

When removal of the diseased organ is obviously necessary, AMPUTATION OF THE PENIS is performed as follows:—The pubes and scrotum having been shaved, firm constriction of the penis is effected by a strip of cotton bandage tied in a slip knot, or narrow band of india-rubber, so as to command the circulation. The operator then grasps and stretches the penis, and, with a single stroke of a long amputating knife, severs the organ well above the diseased part. He next looks for and secures the open mouths of the dorsal arteries of the penis, and the central artery of each half of the corpus cavernosum. The constricting bandage is then slackened, and two small vessels in the corpus spongiosum, on each side of and close to the section of the canal of the urethra, generally require to be tied, and also perhaps some small tegumentary twigs. The general oozing from the section of the corpus cavernosum, which is principally venous, is best arrested by the appli-

cation of ice ; or, if necessary, a little of the infusion of matico or perchloride of iron. A soft vulcanised india-rubber catheter is then introduced into the bladder, and a circular piece of lint, soaked in carbolic oil, and perforated so as to pass over the catheter, is applied upon the cut surface of the penis. By this arrangement the urine is prevented from irritating the raw surface.

After forty-eight hours, or sooner, the catheter is withdrawn, and only occasionally introduced, to prevent closure of the urethra during the cicatrisation. Subsequently the patient should be furnished with a short straight metallic bougie to introduce from time to time, as there is always a tendency to contraction of the orifice, even for years after the wound has healed, unless preventive measures be taken.

It frequently happens after amputation of the penis that enlargement of the inguinal glands takes place and the diseased action recurs in them, cancerous ulceration and fungation supervene, and the patient, after lingering in great suffering and in a loathsome state, dies exhausted.

From what I have seen of the distressing condition of patients, under these circumstances, I have been led to consider the propriety of early removal of the enlarged glands.

In a patient at present under my care, I had to amputate the cancerous penis, which had begun to slough at the glans penis. At the time of the operation there were two enlarged and indurated glands, one in each groin. The wound resulting from the amputation of the penis healed rapidly, but the glands did not diminish in size, and I advised him to return to hospital and have them excised. I did so recently, and the wounds are now completely healed ; and so far the case favours my view of dissecting out affected glands in such cases, before they contract adhesions to important structures, as we thus obviate the distressing conditions which arise if the glands are allowed to ulcerate and fungate.

THE DISEASES OF THE GENITO-URINARY ORGANS IN THE FEMALE have of late years had much attention bestowed upon them by obstetricians, and their treatment has in a great degree become a kind of special practice, forming what is termed *Obstetric Surgery*.

DISEASES OF THE OVARIES, in all that appertains to their diagnosis, and the earlier part of their treatment, belong properly to the domain of obstetric medicine, whilst the operation of ovariectomy belongs strictly to that of surgery. It will thus be evident to you that questions involving such breadth of detail and nicety of discrimination, can hardly be done full justice to in a course of instruction which only professes to deal with surgery. We shall therefore limit our observations to that part of the subject with which every surgeon ought to be familiar, namely, the steps of the operation ; and refer you for fuller information regarding the whole subject to the works of Clay, Spencer Wells, Keith, Bird, and others. It would be great injustice, however, to speak of ovariectomy, now an established operation, and to omit the name of

John Bell, who first proposed it, or of John Lizars, who first boldly carried it into practice in this country, and in several cases with success, in the face of the almost unanimous opposition of the profession.

One or two major points of diagnosis will at once suggest themselves to you, and you would not be justified in proceeding to operate without satisfying yourselves with regard to them. Thus the site, size, definition, mobility, fluid or solid character of the tumour, and any tenderness, must be considered, together with the various phenomena discovered by careful auscultation, and superficial and deep percussion. These must be considered in the light afforded by the age, history, and habit of the patient, together with the progressive symptoms of the case.

Having satisfied yourself of the propriety of operating, your next object must be to do so with the least possible risk to the patient. Due attention must therefore be paid to the hygienic surroundings as regards locality, air, light, cleanliness, and the arrangements for subsequent nursing. The operation consists in opening the abdomen, exposing the tumour, tapping the cyst or cysts, supporting the tumour so as not to strain the pedicle, securing the vessels by ligatures or clamp, finally removing it, and closing the external opening by sutures.

During the operation the surrounding surface of the abdomen should be carefully protected from blood and other discharges which may issue from the wound, or from the surface of the cyst, during the necessary manipulations. This is best effected by spreading over the abdomen beforehand an apron of india-rubber sheeting, with an oval opening in the centre, made to correspond with the site of the proposed incision. The edges of the under surface of this opening are smeared with carbolised adhesive plaster, by which they are closely attached to the skin. After the incisions have been made, and the superficial vessels secured, a piece of carbolised muslin, of a similar size, with a simple slit in the centre, is placed over the india-rubber, and over the part of the abdomen left unprotected by the centre opening in it. The edges of the muslin slit are then attached by acupressure needles to the edges of the wound, and the muslin spread out ready to receive the empty cyst. Thus the maximum of cleanliness and the minimum of exposure are attained, and ovariectomy is rendered one of the most delicate, as it is, in suitable cases, one of the simplest operations.

Having arranged your assistants—one to give chloroform, a second to apply pressure on the abdomen as the cyst is removed, a third to manage the trocar and tube and support the cyst—you should stand on the right side of the patient, and make an incision about four and a half inches in length over the linea alba, beginning two inches below the umbilicus, and extending towards the pubes. Make your way very carefully through the skin, fat, cellular tissue, and peritoneum, securing the smallest bleeding points as you proceed. Having reached the serous cavity, you use the finger for exploration, in order to ascertain the existence or non-existence of adhesions. These having been disposed of, you gently bring the cyst into view and proceed to tap it by means of a trocar and long tube devised for the purpose. The cyst is then gently withdrawn from the abdomen, the pedicle

secured by clamp or ligature, and cut through externally to either. Before closing the wound the opposite ovary should be carefully examined, and any rudimentary cyst either tapped or removed. Every bleeding point must be looked for and attended to. The sutures used for closing the wound must embrace the whole thickness of the cut strictures, including the peritoneum.

In cases where adhesions exist between the cyst and parietal peritoneum, or between it and any of the viscera, the operation becomes much more complicated, and great care is required in breaking up the adhesions or in separating them by the knife and also in securing all bleeding points resulting from such dissection. The after-treatment must be conducted on the general principles already laid down in reference to great operations, paying especial regard to the prompt and complete removal of bloody serum from the cavity of the peritoneum, as its accumulation, decomposition, and absorption are more fatal in their effects than peritonitis, which is also to be guarded against by the strictest antiphlogistic rules; but in ovarian cases a stricter antiphlogistic diet, and free use of ice or iced milk for nourishment and to allay vomiting, seems more indicated than in other cases.

Obstetric surgery also lays claim to the treatment of the various genito-urinary fistulæ. These are designated according to their site—VESICO-VAGINAL, and URETHRO-VAGINAL. They consist of chronic passages or perforations communicating between the cavities indicated through the substance of the intervening septum, and allowing the escape of urine, either in scanty tricklings or a steady stream, according to the size of the communicating aperture, and constituting one of the most distressing infirmities of humanity. Formerly the condition thus established was considered incurable, and we are indebted to Hendrick van Roonhuijsen (1663) for the first feasible plan for its remedy. This was suggested by the operation for the cure of harelip, and consists of a singular procedure, namely, paring the edges of the fistula, and bringing the raw surfaces into close apposition. We shall content ourselves with an explanation of the steps of the operation.

Choose a bright day. Place the patient on her hands and knees, or recumbent on the left side. Insert a full sized duck-bill speculum, of the form shown (fig. 239) on next page, and expose the parts as fully as possible. Pare the edges freely by catching up the lip of the fistula, and denuding the adjacent thickness by a sharp knife or scissors, so as to carry away the complete marginal ring, and leave, if possible, an elliptical opening. This leaves behind a large, wide, raw surface for adhesion. Use torsion, and the application of turpentine, for the bleeding points, and wait for the cessation of hæmorrhage. You next introduce metallic sutures by means of a tubular needle suitably curved, which is alternately inserted and withdrawn until a proper number of sutures are placed in readiness to be secured. You then tie them, one by one, and by this means bring the denuded surfaces into close apposition and exact coaptation. Introduce a catheter, of the form shown, by the urethra, to favour cicatrization and consolidation of the parts. Great care is required in the after-treatment. The bladder must be kept tolerably empty by the use of the catheter, and the

bowels at comparative rest by the administration of opium. After eight or ten days the sutures may be removed, or if the carbolised catgut sutures be used, they may be left to soften and dissolve, and the bladder gradually allowed to distend, and at length to empty itself by its proper expulsive effort.



Fig 239.

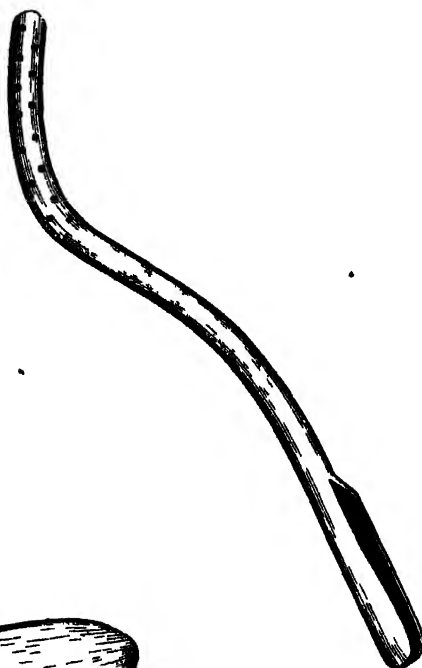


Fig 240.

In some instances the wound may heal satisfactorily, and then again give way. In one of my own cases, a very aggravated one, where the patient had been previously operated on, the wound healed firmly, and urine was retained; but some weeks afterwards, during a menstrual period, the wound again opened to a slight extent, and required to be touched with the heated wire.

Operative procedure is frequently required to repair laceration of the perineum into the rectum occurring during labour, or to remedy a relaxed condition of the vagina leading to prolapsus.

In many cases of lacerated perineum the injury is very limited, the sphincter and orifice of the rectum only being implicated; and in such cases, if the surgeon stitches up the part immediately after completion

of the labour, such wounds often heal very readily, notwithstanding the apparently unfavourable condition of the presence of the lochial discharge. In cases where the rupture implicates the vagina and rectum higher up, the operation consists in paring off the callous edges of the lacerated parts, after the patient has been properly prepared, and

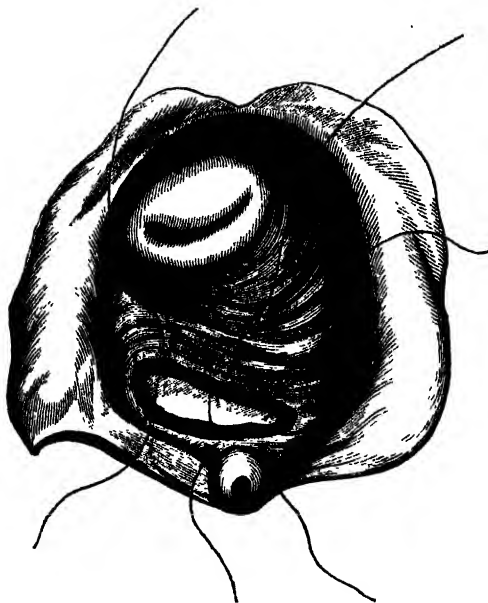


Fig. 241.

then uniting the margins by silver wire sutures, carried very deeply to keep the parts in close apposition. The operation for the relaxed condition of the vagina is performed as follows:—

The patient is placed recumbent, with the thighs separated, as in lithotomy. The large duck-bill speculum is introduced, its concave surface looking towards the posterior wall of the vagina. The operator then proceeds to make a V-shaped incision, the apex of the incision beginning about two or two and a half inches above the orifice of the vagina. The lines of incision as they descend should include the mucous membrane on the lateral wall of the vagina, as well as of the posterior wall, and also the perineal integuments at the orifice of the vagina. The triangular flap of mucous membrane marked out is then dissected off, so as to leave a raw surface. All bleeding points should be secured by torsion, or fine catgut ligature, and the parts washed by a stream of cold water from a syringe, and any oozing arrested by applying a little spirits of turpentine to the surface.

When all oozing has ceased, the surgeon takes a strong needle in a fixed handle, and entering it deeply, at least half an inch from the side of the vagina, carries it across the upper part of the raw surface, and brings out its point at the same distance from the vagina on the opposite side. A strong but fine soft silver or copper wire

passed into the eye of the needle, which is withdrawn, so as to leave the suture, and this is repeated till three or four sutures are passed, so as to bring the perineal and vaginal wounds into accurate and close apposition. These sutures should be left in for at least eight or ten days, unless they give rise to irritation, and the vagina should be kept cleansed by gently syringing it out with weak carbolic lotion twice a day. .

In some of my earlier cases I used to employ the quilled suture, made with strong thread, to support the deeper parts of the wound ; and that method answers very well, and is still preferred by some to the silver or copper wire. It is, in my opinion, of very great importance that the upper point of the vaginal wound be thoroughly secured, both that discharges may not enter and hinder union there, but also to prevent passive hæmorrhage taking place into the vagina when reaction occurs. To secure this, before tying the other sutures, I take a short curved hæmorrhoid needle, armed with fine silver wire or silk, and pass it across the apex of the incision at the highest point, and tie the ligature firmly. In one case, from neglecting this, I had considerable trouble from hæmorrhage into the vagina after reaction.

LECTURE CXIX.

DISEASES OF THE RECTUM—Hæmorrhoids—External and Internal Piles: their Pathology: Constitutional Symptoms arising from Loss of Blood; Treatment—Pro-lapsus Ani—Polypus of the Rectum—Anal Ulcers—Fissure of the Anus: Symptoms and Treatment—Anal Abscess—Fistula in Ano: Different Forms; Treatment—Stricture of the Rectum: Simple and Malignant; Treatment—Amussat's Operation for Artificial Anus—Imperforate Anus: Operations for that Condition.

THE DISEASES OF THE RECTUM, although comparatively few in number, lay claim to a large amount of attention, owing to their painfully distressing and often intractable nature. The functions of the parts render impossible anything like absolute repose, and the healing processes of nature are necessarily much interfered with. Such lesions, therefore, as might in other parts of the body heal without treatment, are by these causes protracted and aggravated, so that, instead of being ameliorated by time, their severity is generally in direct proportion to their duration.

Partly from an ill-founded hope of natural recovery, and partly from delicacy and fear, patients generally postpone consultation until increasing pain and declining health compel them. Our skill is therefore seldom brought to bear on the treatment of such diseases in their earlier stages, so that we must lay our account for dealing with them in their severer forms and complications.

Sometimes the anal orifice and lower part of the rectum are the seats of an aggregation of tumid, vascular, or cutaneous projections, purple or pale in colour, and moistened on the surface with a mucous or sanious discharge. These are termed HÆMORRHOIDS or piles.

Although the protruded mass presents these varieties in colour and character, it will be found on closer examination that the cutaneous variety is placed on the outer side of the sphincter, while the purple and vascular hæmorrhoids arise from the inner side of that muscle. Thus, they are naturally classified into the two subdivisions of External and Internal. The former are generally dependent for their formation upon the pre-existence of the latter, and these, therefore, have the first claim upon our attention.

Internal piles originally consist essentially of a varicose condition of the hæmorrhoidal veins, arising from sedentary habits, constipation, pregnancy, or indeed any cause which retards the return of venous blood towards the heart, but more especially any affection of the liver or abdominal viscera obstructing the Portal circulation. Under such

circumstances the hæmorrhoidal veins distend, and carry before them the loose mucous membrane at the lower part of the rectum, where they bulge out and form a tumour, in some cases almost like a prolapsus ani (plate XXXV., fig. 4). As the disease progresses, the submucous tissue becomes thickened and altered in structure, the arteries supplying the mucous membrane become enlarged, and a separate and distinct growth is established, having special nutrient arteries. Still the disease remains dependent, in a great measure, on the venous dilatation, so that the pain and distension are relieved either by the bleeding of the pile itself, or by the administration of such internal remedies as tend to relieve the congestion of the rectum. This congestion, however, will only be relieved by internal remedies to a certain extent, for the textures partake of their original hæmorrhoidal structure only to a limited degree. The remainder of the mass presents an altered condition of texture, nourished by a persistent vascular supply. Thus, we often find an artery ramifying upon the surface of an ulcerated pile, and the patient suffering from loss of arterial blood caused by ulceration of that surface. Hence the anæmia which often accompanies the disease, hence also the numerous cases of mistaken diagnosis, as the emaciation, palpitation, and dyspepsia, and other constitutional symptoms, closely resemble those arising from disease of the heart. In all cases, therefore, where these symptoms co-exist with pain in the rectum, we should examine for piles, or for any abrasion or ulceration in the mucous surface; and generally, the experience or observation of the patient will materially assist us.

The *Treatment* of hæmorrhoids varies in different cases. When the piles are in the process of formation, and have not yet assumed the character of actual tumours, but of tumid sensitive points upon the mucous surface, nitric acid may be applied with benefit, especially for the flattened granular piles, whether recent or chronic. In order to do this, it is necessary first to empty the bowel, then to get it protruded by the efforts of the patient. The hæmorrhoidal surface being thus exposed, it should be touched with acid—the other portions of the bowel being at the same time protected by lard or oil. For the more advanced prominent hæmorrhoids the simplest, surest, and safest method of treatment is extirpation by the application of ligatures. For this purpose the bowels should be emptied as in the former case, and the piles made to protrude. They should then be seized one by one with a vulsellum, and each transfixed at its base by a needle armed with a strong double hempen ligature. The ligatures should then be separated, and each one tied very firmly, so as to constrict each half of the root. If these be efficiently applied, the tumours will separate in eight, or more generally in ten, days, and leave a granulating surface. The whole of the piles should be ligatured at one operation, for if part of them only are so treated, the remainder will become congested and painful. The chances of enteritis, phlebitis, and other untoward results, are also much lessened by having the operation fully performed at once. Afterwards a full opiate should be given, and the bladder relieved by the catheter from time to time if necessary.

With the view of obviating the injurious effects which are some-

times ascribed to the presence of ligatures, Mr. Henry Smith has introduced a mode of operation by which their use may be dispensed with. The hæmorrhoidal mass is grasped close to the root by a clamp, the blades of which are firmly screwed upon it. The strangled piles are then clipped off close to the clamp, and the actual cautery, at dull red heat, applied to the remaining raw surface. This prevents hæmorrhage, and stimulates subsequent granulation. The outer portions of the clamp are shod with ivory, which, being a non-conductor of heat, prevents the adjoining parts of the rectum from being injured by it. The operation is said to be safe, cleanly, and effectual.

External Piles are placed, as already indicated, on the outer aspect of the sphincter, and are just the remains of what were internal piles situated near the verge. These become gradually protruded, and the mucous membrane assumes the cutaneous character after exposure for a time. They are muco-cutaneous in character and consistency, pale in colour, and round or elongate in form. Sometimes they form a hardened or hypertrophied ring around the margin of the anus, the cutaneous rugæ of which are so far obliterated by their presence; but more generally the skin near the anus hangs in loose folds.

As external piles are so far dependent for their existence upon the presence of internal piles, they should not be operated upon simultaneously with these, because, when the internal piles separate, the contraction of the mucous membrane may, and often does, cause effacement of the external piles and loose skin. Should this fail, however, recourse must be had to appropriate treatment, and this consists in simple excision. This is effected by seizing the piles with artery forceps, and cutting them off with probe-pointed curved scissors. The piles being superficial, any bleeding which may result can be arrested by ordinary means, and there is of course no fear of internal hæmorrhage, while that taking place externally is usually slight. The case might be otherwise, however, were this operation performed at the same time that ligatures are applied to the internal piles, for the congestion following that operation might then give rise to serious secondary hæmorrhage from the external raw surface. We should therefore first tie the internal piles, and then, some time afterwards, if necessary, cut off the external.

PROLAPSUS ANI is a term sometimes used to indicate two different conditions, requiring very different treatment, and therefore I think it right to draw your attention specially to this subject. The one form, true PROLAPSUS OF THE RECTUM, consists of a projection of the whole thickness of a portion of the gut through the relaxed sphincter. The connections of the lower portion of the rectum prevent the whole thickness of that part being projected, and therefore in true prolapsus the projecting mass is formed by the loosely-connected upper part of the bowel invaginated within the lower or fixed portion; the relations of the different parts of the bowel being similar to that in intus-susception in the small intestine. This condition is very frequent in young and delicate, or even in otherwise healthy children, but is comparatively rare, though occasionally met with, in adults. The general appearance

is the projection of a large ovoid or cylindrical florid mass, the everted mucous surface presenting, and on examination we can see and feel the continuous canal of the invaginated portion of bowel. Prolapsus usually takes place when the patient is straining, either at stool or during painful micturition, and it is a very common symptom in cases of stone in the bladder.

When the gut comes down, it generally soon attracts attention, and in the case of children the nurse or other attendant usually manages to reduce it under ordinary circumstances, and in adults the patient manages to do the same for himself by lying down and gently compressing and replacing the gut. In some cases, however, a very large cylindrical portion is protruded, and the reduction being more difficult, the surgeon is sent for. In such circumstances, if attempts have been previously made to reduce the protrusion, you should first apply cold to the parts, and, oiling the surface well, you should apply the pressure chiefly on the lower and central portion of the protrusion, so as gradually to invert and replace that, before you attempt reduction of the whole mass. The old orthodox and popular method of using the rounded end of a tallow candle is not altogether to be rejected, as undignified, as a means of applying pressure on the central portion, but the fingers, properly used, generally suffice to effect reduction.

Reduction having been accomplished, the more difficult part of the treatment is to remedy the tendency to prolapsus, or to palliate that condition. In children all that is necessary is to regulate the bowels, and employ cold bathing, and other means for giving tone to the system, and of course to get rid of any source of local irritation which may be present as an exciting cause. In adults, especially in those in advanced life, we often find that the tendency to prolapsus has been gradually increasing; and in such cases the integuments near the anus are generally relaxed, and form folds radiating from the margin of the anal orifice. When that condition is present, the treatment consists in clipping out the loose skin in longitudinal folds, including also a small fold of muco-cutaneous tissue covering the sphincter. In many cases this effects a permanent cure, if conjoined with appropriate general treatment. In other cases, however, operation is contra-indicated, and then support must be given by a properly-adjusted prolapsus truss.

In neglected cases it may happen that, from congestion and swelling of the protruded portion of gut, it becomes strangulated, and then the condition is very dangerous, as, from the relation of parts, the whole canal is constricted. In such circumstances we should try to press aside the protrusion at one part, so as to get the edge of a probe-pointed bistoury applied to the sphincter, and effect its division, first at one and then at another point of its circumference, and then, having relieved this source of constriction, attempt reduction. But, as in intussusception, it may happen that the constriction is higher up, and may have induced strangulation and gangrene, then the only chance of relief for the patient is to remove the mortified part by including each segment of the protruded gut in a double ligature, and then cutting them off. By doing this we at once remove the gangrenous portion, and expose and free the canal of the bowel higher up. This, however,

should never be done unless the protrusion is gangrenous, and then the double deligation of each half of the projected bowel must be carefully effected. To place a ligature around the whole protrusion would be to tie in and obstruct the lower end of the intestine.

The other form of prolapsus ani I alluded to consists merely of the swollen mucous membrane of the lower part of the gut protruded through the relaxed sphincter, as represented in plate XXXV., fig. 4, and sometimes in a large mass. It is really a hæmorrhoidal affection, totally different in its character from true prolapsus recti. There is no invagination, and the congested projections of the mucous membrane should be dealt with by ligature, as in any other form of internal hæmorrhoids. The removal of loose folds of the anal integument should subsequently be had recourse to.

Another diseased condition of the mucous membrane of the bowel, which is apt to be mistaken for hæmorrhoids, is **POLYPUS OF THE RECTUM**. The polypus consists of a pyriform pedunculated vascular mass springing from the mucous lining, and occupying more or less of the cavity of the bowel, whence it is generally ejected with every fæcal evacuation. Its delicate structure is very ill adapted for such tear and wear, hence it often gives way, and this sometimes gives rise to considerable hæmorrhage. Independently of this contingency, such polypi are in themselves sufficiently troublesome, being sensitive in themselves, and sources of great irritation and severe lumbar pains and discomfort to the patient. They should be tied at the neck with a fine silk thread, and removed by scissors.

ULCERS OF THE RECTUM are not uncommon, and their presence is not only difficult of detection, but is often accompanied by most distressing and debilitating effects. The frequent passive hæmorrhage to which they give rise leads to great anæmia, palpitation of the heart, general emaciation and debility, whilst the comparative absence of local uneasiness may prevent us from suspecting the cause. Sometimes the hæmorrhage is active; and, on the part being protruded, or on using the speculum, a small artery is found bleeding per saltum from the ulcerated surface. In such a case the bleeding point must be secured either by means of seizing the vessel with artery forceps, or by transfixing the orifice with a tenaculum, and applying a silk ligature.

A careful examination of the internal surface of the rectum, by means of the finger, may lead to the detection of deeper ulcers, but the surest method of diagnosis is to examine with the speculum. The forms of these instruments in general use are not well adapted for examination of the rectum. They are either fenestrated on one side, or have an oblique opening at the upper end. When the former are used, the loose mucous membrane projects into the cavity of the speculum, and the others—those partially open above—are still more objectionable, as they permit not only the mucous membrane but discharge from the bowel above to pass into the speculum. I have of late years devised a form which, if well made and carefully used, answers exceedingly well for examining the lower part of the bowel. It is

made of glass, of the ordinary cylindrical form, perhaps a little longer and larger, closed at the top. One-half is coated and silverised in the usual manner, the other half is left clear; and the glass should be very equal, and free from waves or flaws. Before this speculum is introduced it should be immersed in warm water to prevent its being dimmed by the heat or moisture of the bowel, and then, when introduced, by gently turning it round, we obtain a very perfect view of the interior of the bowel. The only difficulty is caused by the folds formed by the laxity of the mucous surface, and that is best obviated by the size of the speculum tube. Were it possible to combine the clear glass side with an expanding metallic speculum, the instrument would be perfect for the purpose of diagnosis.

The *Treatment* of anal ulcers consists in touching them with nitrate of silver or sulphate of copper.

Ulcers of a more troublesome character are sometimes associated with FISSURE OF THE ANUS, and, when not syphilitic or malignant, are amenable to the same treatment. This consists in transfixing the ulcer by passing a sharp bistoury through its hardened base, and a portion of the sound texture beyond it. It is generally situated close to the internal extremity of the fissure, and is often continuous with it. After-treatment by lotions may sometimes be necessary.

FISSURE OF THE ANUS is the term used to denote a crack or chap in the mucous membrane of the anal orifice, extending longitudinally in the direction of its rugæ, and lying concealed from view between them, or by a hæmorrhoidal projection. It can only be brought into view, therefore, by forcibly separating the nates, and then dilating the anus. This procedure, which can scarcely be effected except when the patient is under chloroform, will disclose a red irritable-looking crack, with hardened base and edges, which will be either dry, or moistened on the surface with a muco-sanguineous discharge.

The diagnostic system of the disease is an intense agony, which reaches its acme during and immediately after the act of defæcation. The bowel feels as if it were dragged up, and sometimes the sphincter becomes spasmodically closed, so that the fæculent matter is retained, giving rise to symptoms like those of intestinal obstruction, owing to the absolute constipation which often occurs. Reflex irritation of the urinary organs is sometimes a prominent symptom.

Having made sure of the diagnosis, the *Treatment* is simple and effectual. All that is required is to take a narrow probe-pointed bistoury, lay the edge of this within the crack, and cut down through its hardened base. If the sphincter be much contracted, the incision should be extended through a few of its fibres; the muscle should be completely divided if the spasm has been intense. The operation may also be conducted by the transfixion method already indicated, by making use of a sharp-pointed narrow curved bistoury, and passing it under the dense base in the line of the fissure, bringing it out beyond its upper extremity, and cutting outwards. M. Ribes, who first drew attention to this operation, considered that it was absolutely necessary to divide the whole sphincter, and in some cases it is certainly well to

do so, in order to leave the parts at rest, but the essential part of the operation is to divide the hardened base. This is followed by immediate and entire relief of the patient. A coarser method has of late years been occasionally used, of introducing the operator's forefingers within the sphincter, and then forcibly tearing up the fissure; but it is a very coarse and uncertain procedure.

ABSCESS IN THE VICINITY OF THE RECTUM was alluded to in the early part of the course, but it is necessary briefly to reconsider the subject here, owing to its connection with FISTULA IN ANO.

From some of the local causes of irritation which we have just been considering; from the presence of foreign bodies, such as portions of bone, perforating the rectum and lodging in the tissues external to it; exfoliations from the pelvic bones; or, from a debilitated habit of body, inflammation may be set up in the neighbourhood of the rectum, and result in the formation of abscess in the ischio-rectal fossa. The pus, bounded below by the dense integument of the hip, by the ischio-rectal fascia, and levator ani internally, and the strong obturator fascia externally, makes its way towards the rectum at the inner and lower part of the space where the ischio-rectal fascia becomes thin and cellular immediately above the sphincter ani, and there it undermines, thins, and ultimately perforates the bowel; the abscess very generally opens also towards the integuments of the hip, and so gives rise to sinus or fistula.

After evacuation of the abscess the openings formed and the tracts or cavities connected with it do not heal, for mucus or thin feculent matter or flatus from the gut passes into them and keeps up the irritation, and these causes, together with the constant movements of the parts affected, prevent the healing process by contraction from taking place, and as a result we have the formation of Sinus or Fistula. The term is used to express that condition which we meet with in cases where the cavity of an evacuated abscess has failed to contract and heal, but where it remains open and continues to pour from its surfaces a thin unhealthy discharge of a gleety or muco-purulent character. Gradually the walls become thickened and callous, the cavity diminished in size, the lining surface smoothly glazed, like a mucous membrane, the discharge lessened in quantity and altered in quality. The action is sluggish, without tendency to heal, and thus the diseased condition becomes established. On introducing a probe at the opening, it is found to pass inwards in a widening course, while here and there it may meet with projections which render its progress irregular and tortuous. After a time these attempts at closure may become more numerous and continuous, until at length the original cavity, thus limited by them, may assume the character of a small hardened tubular canal. From the inner surface of this channel a thickened moisture exudes, and lymph is effused into the surrounding textures, so that the channel becomes more callous and persistent, having just sufficient vitality to prevent it from sloughing, but not enough to produce healing action. A fistula may be either straight or tortuous, generally the latter, and it may have either one or two openings. If it has only

one opening it is termed incomplete or blind: if it has two—the one opening internally, the other externally—it is termed a complete fistula. An incomplete fistula may have its opening either on the internal or external surface; in the former case it is more likely to become a complete fistula than in the latter, on account of the tendency of discharges to make their escape through the integument.

These fistulæ have little tendency to heal, although, after the opening or openings are formed, their cavities become considerably lessened, forming a simple elongated channel, the surfaces of which are constantly moistened by a thin gleety discharge, which is alike pathognomonic of feebleness of action in the part and in the constitution. On introducing the probe by the external opening its explorations are by no means restricted to such a narrow channel, for the efforts at closure have been weak and insufficient, and are easily broken down, so that the probe may possibly traverse the whole extent of the original cavity, and thus extend to beyond the internal opening, which seldom exists higher up than the distance of one inch from the orifice of the anus, for the anatomical reasons already stated. The external orifice of the sinus may exist anteriorly or posteriorly in relation to the bowel, but it generally occurs at either side of it. The size is generally small, and it may be surrounded by pouting granulations, which form an elevated rim or lip to the orifice. Into this opening the probe is passed, the forefinger of the left hand being at the same time inserted into the rectum. By means of the probe we ascertain the extent and direction of the sinus, and by means of the forefinger being gently opposed to it from within the bowel, we search for an opening, through which, if it exist, we can readily pass the probe. If there be no internal opening present, we ascertain the part of the bowel which has become most attenuated by the diseased action. Besides the fistula proper there are often numerous sinuses passing in different directions towards the hip and perineum.

The *Treatment* will depend greatly upon the nature of the case. If you have been able to discover an internal opening, and have had great

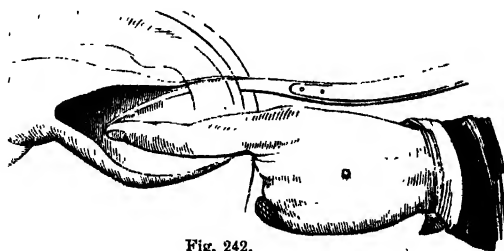


Fig. 242.

difficulty in finding it, you will do well not to withdraw the probe, but to retain it, and introduce a bistoury into the bowel, and cut out the probe. Thus, the intervening septum between the bowel and the cavity of the sinus will be laid freely open, and the diseased surface will gradually contract, granulate, and heal. If the internal opening be

easily found, you may withdraw the probe, and introduce in its stead a probe-pointed curved bistoury; although I consider it advisable to bend and leave in the probe in all cases, to ensure complete division of the septum. The probe point of the bistoury is pressed against the point of the finger within the bowel, and both are withdrawn. Thus you will make a simple clean cut through the intervening textures

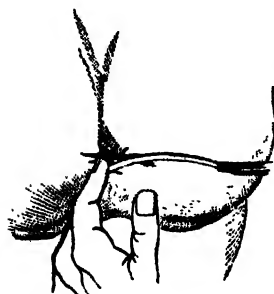


Fig. 243.

constituting the septum, and leave the surfaces to granulate and heal. Should you fail to discover an internal opening, you should select the thinnest, most attenuated part of the septum, and forcing the bistoury through it, perform the same manoeuvre. In the case of an internal fistula, with no external opening, the internal opening is usually large and easily felt with the finger in the gut, and the integuments near the anus are boggy and undermined, so that, by making a small incision there, it is readily converted into a complete fistula,

and dealt with as already described.

Sometimes, instead of using the knife, irritating injections have been employed with the view of causing obliteration of the sinus, and various other methods have been employed, sometimes with success. As a general rule, however, such endeavours serve only to lose time, and to waste the strength and resources of the patient. For the obtaining of direct and satisfactory results nothing can equal the operation just recommended.

Previous to the operation the bowels should be thoroughly evacuated by means of an enema, and after the operation an opiate is given to prevent action of the bowels for a day or two.

Great care and cleanliness are required in the after-treatment. When the hæmorrhage, which is generally slight, has ceased, a piece of dry lint should be gently laid in, not stuffed into, the cavity. This serves to favour granulation, and to prevent the newly-cut edges from reuniting and healing up. After this lint is removed I seldom introduce more dressing, but merely touch the surfaces lightly with nitrate of silver occasionally. This serves the purpose of slight stimulation, and simplifies the after-treatment, whilst the other plan of stuffing lint into the wound prevents the healing process, and induces undue action. Little else is required. The patient should be kept at rest in bed, and attention given to the general health.

From the frequency with which the disease under consideration is associated with disease of the lungs, no case can be said to be properly treated where the state of these organs is overlooked. If phthisis be far advanced, it would be obviously unwise to interfere locally for the relief of fistula; but where there exists only the predisposition, a good local result may be obtained, and constitutional benefit may be derived from the cure of the fistula. Those remedies which tend to support and restore the general health must be employed, and change of climate recommended as soon as possible.

In the lower bowel we sometimes meet with a condition similar to that described in connection with the œsophagus, and constituting **STRICTURE OF THE RECTUM**. This arises at different points, generally either $2\frac{1}{2}$ inches above the sphincter, or at the upper part of the rectum, close to the promontory of the sacrum. It may be simple or malignant in character, and may vary in extent from a simple semilunar fold or puckering of the mucous membrane to a complete hardened ring, gradually narrowing to occlusion; or the contraction may arise from without, owing to inflammation and contraction of the peritoneal investment of the gut. This latter form is usually situated near the promontory of the sacrum. The rectum may also be spasmodically contracted at some point, and for the time this state presents all the symptoms of stricture. This last form can hardly be regarded as a stricture; it is just a functional disturbance, created by the irritation of some other disease in the neighbourhood.

When stricture exists low down, its presence can be readily discovered by an examination with the finger. When it arises at a part beyond the reach of the finger, the altered form and calibre of the fæces will guide us towards a diagnosis, and we will be further assisted by various constitutional symptoms. The additional work required by the bowel in forcing the fæces through the constricted part causes the portion immediately above the stricture to become greatly distended. This leads to general fulness of the abdomen, which becomes at length oppressive; it also leads to vomiting, and various other reflex symptoms.

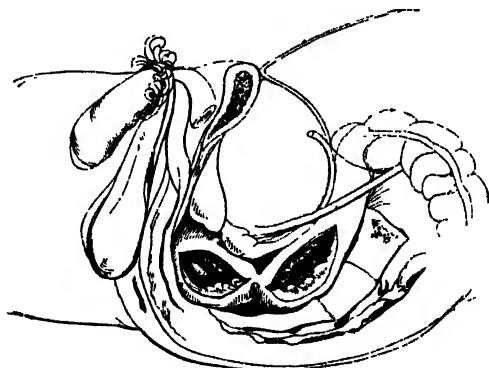


Fig. 244.

The constriction further leads to great irregularity of the bowels. Severe constipation, frequently alternating with equally severe diarrhoea, in which the semifluid contents, instead of coming away regularly, are expelled in violent and sudden gushes.

The irregular nodulated and indurated character of the circle of the contraction, and the peculiar sanious and fœtid discharge which accompany the malignant disease of the bowels, taken in conjunction with the history of the case and the constitutional cachexia, will serve to distinguish the cancerous form of the disease from the simple stricture.

In the simple stricture we proceed by vital dilatation, on the same principle as in stricture of the œsophagus or urethra, by the introduction of graduated bougies, or sponge-tents, using opiate suppositories to allay irritation if excessive.

In malignant stricture, though we may require to use instruments occasionally in order to keep the gut pervious, still we can only look for palliation from such procedure. Sometimes the operation of opening the descending colon may be had recourse to, in this or in cases of simple stricture situated high up, but even this is only palliative, although better than passing bougies through an irritable cancerous rectum; but in cancer the disease will prove fatal sooner or later.

EXCISION OF RECTUM.—In malignant stricture the treatment is chiefly palliative, but, occasionally, when an opportunity of seeing a case in the earlier stages occurs, and the constitutional conditions do not contra-indicate it, the operation for removal of the diseased part may be recommended. The method I prefer is that devised by M. Rizzoli of Bologna, which is accomplished by the aid of knife, Paquelin's cautery, and scissors.

The patient is placed on his left side, the left thigh extended and the right well flexed over the abdomen, while the skin of the nates is equally retracted. An incision beginning on the left of the coccyx is carried down the raphé to the boundary of the morbid growth at the anus. This incision includes skin, subcutaneous tissue, and the levator ani muscles, and exposes the cellular tissue surrounding the rectum, which is easily separated from it by the finger. To avoid severe hæmorrhoidal bleeding, the incision round the anus is continued by Paquelin's cautery, and the lower part of the bowel thereby isolated. The surgeon then seizes and drags the rectum backwards, exposing its anterior connections, which are carefully divided by scissors, carefully avoiding injury of the bulb of the urethra, prostate, or peritoneal fold. The healthy intestine is transfixed by a double ligature and each half firmly tied, after which the diseased mass is removed by the cautery. The cavity resulting is brushed over with a solution of chloride of zinc, stuffed with carbolised oiled lint, which is secured by a T-baudage.

In the rectum we are liable to meet with a form of stricture which we might diagnose to be malignant, while it is really not so. This is a syphilitic affection, ulceration of the canal leading to its contraction. It is accompanied with great irritation in the part, and the emission of a peculiar sanious and fœtid discharge. In addition to these local manifestations, we have the constitutional cachexia as in malignant disease; but then we have the presence of other syphilitic lesions to guide our diagnosis, such as maculæ, enlarged glands in the neighbourhood of the groin, nodes, and very often a corresponding history. Appropriate constitutional treatment must be combined with local measures, and a favourable prognosis may be given. Hence we must be very cautious in our diagnosis.

THE OPERATION OF COLOTOMY for the purpose of forming an artificial anus is performed in two positions; first, but rarely, on the

right side, to relieve obstructions at the caput cæcum resulting from affections of the ascending or transverse colon, or for removal of foreign bodies lodged in the caput cæcum itself; second, and more frequently, on the left side, for affections of the rectum or sigmoid flexure of the colon. The method of operating is similar in both cases, excepting that the patient is laid on his right side when the operation is performed at the left side, and *vice versa*.

I shall describe Amussat's operation for opening the descending colon, an operation presenting no great difficulty when the gut is much distended. In many cases, however, where it is necessary to operate, the colon is not distended, hence to avoid mischievous manipulations, it is well to consider the anatomical relations of this viscus to the peritoneum and latero-posterior abdominal parietes.

The normal position of the descending colon may be most precisely indicated by a line drawn from the middle of the last rib to a spot one inch posterior to the centre of the crest of the ilium, which may be marked with iodine or nitrate of silver previous to operating, a precaution which will be found useful in cases where the bowel is not readily discovered.

It is throughout its course connected to and partially invested by the peritoneum, which covers its front and sides, leaving the posterior aspect bare. This relation of the peritoneum to the anterior two-thirds of the colon prevents its displacement behind the ilio-costal line above mentioned, and the operator should therefore avoid any working at the back part of the wound, or fingering amongst the fatty and cellular tissue lying in front of the quadratus lumborum muscle, as such interference can only lead him into undesirable proximity to the left kidney. The instruments required for this operation are as follows:—A sharp-pointed scalpel, blunt-pointed bistoury, blunt hooks or copper spatulæ, a large cyst trocar and canula such as is used in ovariectomy, curved needle and sutures, Pæan's forceps and artery forceps.

The operation is performed as follows:—The patient being laid on his right side, with a round pillow under the loins, the operator commences his incision at the external margin of the erector-spinae muscle, at a point nearly midway between the crista ilii and the last rib, but slightly nearer the former, and carries it outwards and forwards, parallel to the crest of the ilium, for from three to four inches, through the skin, fat, and fascia. The free margins of the latissimus dorsi and external oblique, separated by a slight interval, are now brought into view, the cellular tissue divided, and the edges of these muscles held apart or partially divided, when a little more dissection exposes the lumbar fascia, the common attachment of the internal oblique and transversalis muscles. This is first divided in the line of the external incision, afterwards notched crucially, to give room; after which the surgeon, by gentle use of knife and finger, works his way cautiously forward so as to expose the extra-peritoneal aspect of the colon.

This being found, great care must be used in opening the gut, lest feculent matter escape into the abdominal cavity. To prevent this, the surgeon, having carefully guarded the parts as in ovariectomy, plunges into the bowel a large trocar, to the canula of which a long

india-rubber tube is attached, and by this means empties the colon of its more fluid contents. He afterwards draws the opened bowel forwards external to the skin, and having dilated the opening by a crucial incision, stitches the mucous membrane to the integuments by continuous suture, places a piece of oiled lint round the opening, and inclines the patient to that side to favour the escape of feces.

The sigmoid flexure of the colon is then cleared of its contents by an injection administered either at the time or a few hours later, according to the strength of the patient. An opiate suppository should be placed in the rectum; great attention paid to cleanliness, and the diet should be principally milk and farinaceous food for some days. A similar procedure will enable you to open the caput cæcum on the right side.

In proper cases, as in obstruction of the bowels from stricture of the rectum, or in cases of obstructed bowel, where the course of the colon can be traced distended with feces, there can be no question as to the propriety of performing Amussat's operation. But in cases where the colon is not distended, or only distended by gaseous contents, as evidenced by percussion, and that distension only arising at a late period of the symptoms, then the probability is that there is obstruction in the small intestine, and we must decide as to performing the more questionable operation of gastrotomy. The difficulties and complications which may arise, both as to diagnosis and operative procedure, may be judged of by a case which will be found in the *Clinical Cases*, page 1055.

We have hitherto been considering the diseases to which the normal rectum is liable; but I must now treat of an abnormal condition of it, in which the external opening and sometimes the lower part of the rectum are absent. This deficiency is termed IMPERFORATE ANUS. It is of course a congenital malformation. It is generally noticed at once by the medical attendant or nurse, but in some cases, where the rudimentary indentation of the anal orifice is deeply marked, it may escape detection till the absence of evacuation of meconium attracts attention, and leads to the discovery of the malformation.

Sometimes the occlusion is quite superficial and membranous, so that the distended bowel causes it to bulge, and the dark colour of the contained meconium can be seen through the thinned integument. In other cases the rudimentary anus is separated from the termination of the bowel by the thickness of an inch or more of intervening cellular tissue, and not unfrequently the bowel is found to communicate with the vagina, in the female, or the urinary bladder, or more usually the urethra, in the male.

In some instances no trace of the anal depression is to be seen, and this indicates that the malformation is in an extreme form, and that the cul-de-sac of the gut is placed high up in the pelvis. In many cases of imperforate anus other congenital malformations exist, and the most frequent is imperfect development of the kidneys. In one infant on whom I operated, where the gut terminated high up, the child lived

OPERATION FOR IMPERFORATE ANUS.

for three days, and died with well-marked symptoms of uræmia, scarcely a table-spoonful of urine being secreted during its short lifetime. The whole interior of the bladder was studded with dark nodulated masses, like effused and hardened blood, and there was scarcely any trace of the kidneys except a cyst attached to the ureters. In other cases I have seen similar conditions.

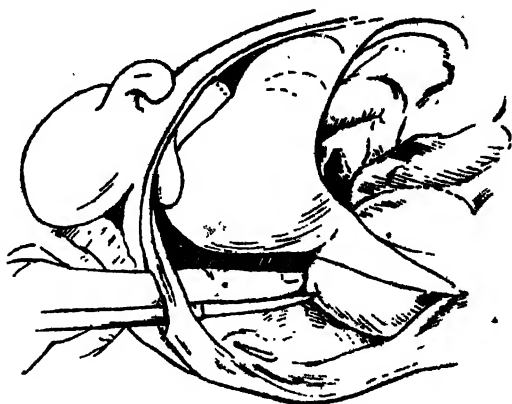


Fig. 245.

In regard to the *Operation for Imperforate Anus*, that will be modified by the nature and extent of the malformation. In the simpler forms all we require to do is to take advantage of the swelling of the distended bowel when the infant is crying, and to make first a longitudinal and then a transverse incision, and introduce the tip of the little finger and dilate it, and nature will keep the orifice open. When the rectum terminates high up we must proceed more carefully and methodically. We must keep in mind the small size of the pelvis, and the relations of the bladder and internal iliac vessels. The bladder should be emptied by a catheter, to diminish the risk of its projection being mistaken for the *cul-de-sac* of the rectum; because, when the lower part of the gut is absent the bladder falls downwards and backwards into the pelvis. This precaution having been taken, the operator should incise the integument exactly in the position of the anal depression. The point of the narrow bistoury should be inserted at the anterior part of the depression, with its edge directed towards the coccyx, and carried back to beyond the posterior margin of the depression, then a transverse cut is made on each side, so as to make a crucial incision and give room to introduce the finger. In those cases where no trace of the anal depression exists, the surgeon must judge of its position by the relation of the tuberosities of the ischium and other parts of the perineum. The first incision should be carried deeply through the textures, so as to open into the lower part of the pelvic outlet, and the finger is then introduced along the hollow surface of the sacrum, the point directed very slightly upwards, but never forwards, for the lower *cul-de-sac* of the peritoneum with the contained viscera might be

wounded. In general the *cul-de-sac* of the bowel can be felt when the child cries, or when the abdomen is pressed upon by the assistant. By passing the narrow bistoury or a flat trocar and canula upwards in the direction indicated, the bowel is punctured and some meconium escapes. A probe-pointed bistoury is then introduced into the aperture so made, to enlarge it, and allow of the free escape of the meconium, and subsequently of the fæces. Fig. 245 gives a plan of the operation, and shows the relation of the contracted bladder and peritoneal sac to the pelvic cavity and *cul-de-sac* of the imperfect rectum, but it is very rare indeed that the finger can be introduced, as there represented, to guide the knife; the space is too small. We must feel for the gut with the finger, and then withdraw it, and guide the knife by the information so received. In some cases I have managed to introduce a tenotomy knife over the finger to open the bowel.

When the opening is enlarged, if the *cul-de-sac* be placed very high, we should try by gentle pressure and traction to bring it down nearer to the surface, otherwise there is risk of effusion of fæculent matter lodging in the hollow of the pelvis and leading to fatal consequences. In all such cases it is necessary to maintain the orifice patent, and to prevent contraction during the healing process. A portion of gum-elastic, or wax bougie, is generally used for this purpose, or a portion of sponge tent. The sponge tent is useful after a time, but too irritating at first. The substance I have found to answer best, immediately after the operation, is a conical suppository composed of beeswax and soap. Afterwards a large bougie or a sponge tent should be introduced occasionally to prevent contraction.

The tendency to contraction continues for a long time—for years indeed. In one case in which I had operated, I was consulted by the patient when he was about twenty years of age on account of the inconvenience caused by the contraction of the orifice. I found it would hardly admit a No. 9 urethral bougie, yet he was in perfect health. I enlarged the orifice freely by a crucial incision, and advised him as to the occasional use of the rectum bougie, and as I have heard nothing of him for many years, I presume the contraction has not recurred. One peculiar anatomical fact in regard to imperforate anus is, that in the worst form, even when there is no anal depression, it has been found, on dissection, that the fibres of the superficial sphincter can be distinctly traced under the skin.

In cases where the *cul-de-sac* cannot be reached, it has been proposed to open the descending colon in the left lumbar, or the sigmoid flexure of the colon in the left iliac region, and successful cases are recorded; but in general we could hardly expect, or even I may say desire, such a success in an infant.

CLINICAL CASES.

INJURIES AND DISEASES OF THE URINARY ORGANS.

CASE OF RUPTURE OF THE URINARY BLADDER.

(Read before the Edinburgh Medico-Chirurgical Society, 1860.)

THE following case of ruptured bladder seemed to me of sufficient interest for publication, as a contribution towards the illustration of a class of injuries in which, as in the present instance, *post-mortem* examination not unfrequently reveals conditions which could scarcely have been predicted from the symptoms during life:—

On the night of the 10th December last, J. J., a healthy man, aged 32, had been supping with some friends, and feeling his bladder much distended, left for the purpose of making water. On going hurriedly down stairs he slipped his foot, and fell backwards with considerable force, the back of his head striking against one of the steps. He was found lying insensible, and was carried upstairs to the house he had just left, and laid on a bed. In the course of an hour the effects of the concussion diminished; he became more conscious, was restless and somewhat incoherent, constantly crying out he wanted to make water, and vainly attempting to do so. As this state continued, he was put into a cab and driven home to his own house; and next morning (the 11th December 1859), his wife sent for Dr. Menzies, who visited him at 10 A.M. He was then quite sensible, but still unable to empty his bladder. Dr. Menzies passed a full-sized catheter easily, and drew off nearly a chamber-potful of bloody urine, with great relief. He however complained of severe pain over the abdomen, increased on pressure; his pulse was hard and wiry; and there was tympanitic distension. Dr. Menzies bled him to a slight extent, with considerable relief to the pain; and as it appeared his bowels had been constipated for some days previously, an enema was ordered to be given. In the evening Dr. Menzies again drew off a large quantity of urine, much less bloody; his bowels however had not acted, the tympanitis was increased, and he had occasional vomiting.

I saw him on the morning of the 12th December, at Dr. Menzies's request. At that time the anxious expression of his face, shrunk features, and sharp irregular pulse, together with restlessness, frequent vomiting of greenish fluid, and hiccup, taken in connection with the history of his case, left no doubt on my mind that rupture of the bladder had taken place. I introduced a No. 12 catheter easily; but as Dr. Menzies had shortly before drawn off his

urine, there was very little in the bladder, and it was slightly bloody. As he suffered greatly from the distension of the bowels, another enema and a purgative by the mouth had been administered; and I recommended that after the bowels had acted the use of opiates should be commenced, and directed a sinapism to be applied over the epigastrium to relieve the vomiting. Next day I found him easier; the bowels had acted freely, with complete relief to the pain and tympanitis, so that he could bear pressure over any part of the belly. There was still small quick pulse, the anxiety of countenance remained, and vomiting and hiccup continued, although much less frequent than before. The urine which had been drawn off was in large quantity, perfectly clear, and free from the slightest sediment or muddiness. The opiates were ordered to be continued; and he was directed to have a little wine and some essence of beef for diet. On the 14th I found he had passed a very restless night, and he seemed much weaker; the pain, vomiting, and hiccup had diminished, but the expression of the face was very anxious. The urine which had been drawn off was copious in quantity and quite clear. The treatment was continued, with the exception of a little brandy in place of wine, as the latter turned acid on his stomach. During the 15th he became rapidly worse, the vomiting and hiccup recurred with increased intensity, and he gradually sank, and died at half-past seven P.M. of that day.

Post-mortem Examination.—On opening the abdomen, the large intestine was found contracted, the small intestines and omentum were rather more congested than naturally; but the peritoneal surfaces presented the usual smooth glistening appearance. There was no marked vascularity either of the parietal or visceral peritoneum; its surfaces seemed more bedewed with serous secretion than usual, although this did not amount to serous effusion. There were no adhesions, and only a very few minute flakes of lymph towards the epigastric region. On looking at the hypogastric region the bladder was seen to be contracted (the urine having been drawn off shortly before the patient's death); and on observing the viscus as it lay *in situ*, it presented the appearance of a rent at the posterior aspect of its superior fundus, apparently not larger than half an inch in length, its peritoneal investment, as well as its proper coats, having given way; the margins of the rent were in close contact, so that it looked like a mere fissure. A little turbid urinous fluid and some folds of small intestine occupied the inferior *cul-de-sac* of the peritoneum; but no fluctuation or distension could be detected on examination by the finger in the rectum. On removing the bladder and examining it carefully, I found the rent of its coats to be much more extensive than it seemed to be when seen in position in the body, as it was now found to measure about two inches in length, as seen in the preparation.

Remarks.—The features of this case which seem to me most suggestive of remark are: 1st. The small amount, or almost entire absence of those morbid appearances which generally result from an inflammation of the peritoneum characterised by such urgent symptoms, and such an extremely irritant exciting cause. When we recollect the amount of organic changes—such as extreme and general vascularity of the serous surface, the effusion of turbid serum and masses of lymph, and the matting together of the viscera—which usually follow the escape of even a small quantity of the contents of the intestines in cases of minute perforation; or in cases where a comparatively small quantity of urine is extravasated into the sub-peritoneal cellular tissue, it seems to me that the absence of such appearances in this and some other similar cases recorded, can only be accounted for on the supposition that the extremely destructive character of the extravasated urine in large quantity,

and in immediate contact with the peritoneal surface, may so depress the vital powers as to prevent the formation of the ordinary inflammatory products; a supposition, however, somewhat difficult to reconcile with the acute nature of the symptoms during life, and the period intervening between the receipt of the injury and its fatal termination.

The next remarkable feature of this case, and that which is most difficult of satisfactory explanation, is the occurrence of retention of urine, requiring to be relieved by the use of the catheter whilst there existed a rent in the bladder, through which we might have expected the urine to have escaped freely into the abdominal cavity. I know that it has been suggested that in such cases the urine does escape from the bladder, and that it is drawn off from the peritoneal cavity by the catheter passing through the wound of the bladder. The reasons assigned for this opinion are, *first*, the large quantity of urine drawn off in some of the cases being, in amount, beyond the capacity of the bladder; and *secondly*, the apparently physical impossibility of any considerable quantity of urine being retained in the bladder when such a wound exists in its coats. In regard to the former of these reasons, I do not consider it of much weight; because, in common with every surgeon who has had much experience in urinary cases, I know that not unfrequently cases of retention are met with where the quantity of urine drawn off is so enormous as to show it to be very difficult to calculate the capacity of the bladder under certain circumstances. As to the second reason alluded to, whilst I grant the great difficulty of affording a satisfactory explanation of the retention of urine co-existing with such a wound of the bladder, yet the opposite hypothesis presents physical conditions equally difficult of explanation; and it will not do to reject all the phenomena observed during the progress of a case merely because we have great difficulty in explaining the co-existence of certain apparently opposed physical conditions.

In the present case, the symptoms, both objective and subjective, noted during life, appear to me to amount to a demonstration that the urine evacuated by the catheter was contained in the bladder, and not diffused through the peritoneal cavity. A tumour corresponding to the distended bladder could be felt above the pubis, and disappeared when the urine was drawn off. The quantity on each occasion was not beyond the average amount in retention, and after the first thirty-six hours it was clear and natural in appearance, and it flowed off through the catheter in a full, even stream. Then as regards the subjective symptoms, the sense of distension felt by the patient was unequivocal; not the mere sensation arising from irritation, which frequently does occur in cases where the wounded bladder contains little or no water, but a sensation arising and increasing as the urine accumulated, and relieved when it was evacuated by the catheter. I consider this symptom as of importance; for we know that when the urethra gives way and extravasation occurs in a case of retention from stricture, the patient feels immediate relief from the sense of distension, and often thinks he is passing water naturally; and we would expect the same to be the case if the fluid had escaped from the bladder into the abdomen.

On the other supposition, that the urine had been diffused into the peritoneal cavity, how can we reconcile this with the symptoms observed? In cases where the urine has become diffused into the cavity of the abdomen—as in two cases mentioned by Dr. Innes, C.B., when this case was read to the Society—only a very small quantity of urine can be drawn off by the catheter. Nor, supposing the catheter to pass through the wound of the bladder, and reach the fluid, would it be likely to flow off in a continuous even stream, diffused as it must necessarily be amongst the viscera; and as a considerable

quantity must gravitate towards the pelvic *cul-de-sac* of the peritoneum, that could not have been drawn off, and would have been found there on the *post-mortem* examination.

I believe the best explanation of the case is, that the rupture being longitudinal, the contraction of the fibres of the muscular coat of the bladder, from their arrangement, would render it a mere fissure during life; and the projection of the looser mucous lining might have a valvular action, preventing the urine flowing out by the wound, except very slowly and in small quantities, and only after a considerable distension had occurred.

In conclusion, I would advert to the bearings which this case has on the treatment of such injuries. Whilst, for my own part, I expect but little benefit from any treatment, inasmuch as I consider that the urine extravasated at first into the abdomen is in itself sufficient to induce the fatal effects, still, the length of time and the temporary amelioration of symptoms which occurred in this, and which have been noticed in similar cases, afford some glimmerings of hope as to more favourable results, could we but procure such a continuous drain of the urine from the bladder as to prevent it accumulating, and so obviate any further escape into the abdomen, and permit the wound in the bladder to heal. To introduce and secure an ordinary catheter in the bladder would be dangerous, as its point would be apt to pass through the ruptured part; but I think a very short-pointed catheter, similar to what is used in cases of vesico-vaginal fistula, and with the part corresponding to the anterior portion of the urethra, bent so as to droop, might answer the purpose; or the operation of puncturing the bladder from the rectum, and leaving the canula or gum-elastic tube for some days, would afford a still surer and more efficient drain. The objection to the latter operation, however, would be, that there is generally no absolute certainty as to the nature of the injury; and we would naturally hesitate to perform an operation which might possibly be unnecessary.

The state of parts in this case showed me that the operation of puncturing the inferior *cul-de-sac* of the peritoneum, to evacuate urine supposed to be lodged in the peritoneal cavity, must always be uncertain, and often dangerous; whilst, as the fluid is diffused, it would not be fully drawn off, and can only be possible in those very rare cases where the urine has accumulated, and is limited by adhesions—a condition, of the existence of which I am very sceptical.

CASE OF RETENTION OF URINE IN A POST-VESICAL CYST, REQUIRING TO BE PUNCTURED FROM THE RECTUM.

(From Clinical Report, 1863-4.)

J. W., *æt.* 29. Had experienced some difficulty in micturition for some months previous to admission, but never amounting to complete retention until two days previously. Complete inability to micturate came on somewhat rapidly after his having been exposed to cold and wet. He was seen by a medical gentleman, who passed a catheter and emptied the bladder; but on the following day he failed to get anything but blood through the instrument. When brought to the Infirmary the patient was in great agony from the accumulation of urine. Mr. Spence had some difficulty in passing a catheter, owing to the previous formation of a false passage; but when he succeeded in passing a No. 8 catheter, and drawing off the urine from the bladder, he found that there still remained a considerable swelling in the hypogastric

region. On examining per rectum he detected a fluctuating swelling behind the prostate, which he at once pronounced to be cystic, and proposed to puncture it when the urine had re-accumulated in the bladder. There was no stricture of the urethra, but the tilting forwards of the prostate by the swelling behind, had evidently given rise to the difficulty in passing an instrument. In the evening Mr. Spence punctured the cyst per rectum, and drew off twelve ounces of a pale, slightly albuminous fluid. Thereafter the patient passed urine without assistance, and the swelling and dulness on percussion disappeared from the hypogastrium. Inflammation of the post-vesical cyst supervened; the latter was at the end of a fortnight again punctured, and a large quantity of purulent fluid evacuated; the canula was left in to act as a drainage tube, but happening to become displaced had to be withdrawn, and of course could not again be passed until the fluid re-accumulated. Sedatives and diluents were frequently administered. Hot hip-baths were repeatedly used, and poultices or hot fomentations continually applied to the hypogastrium; but the patient became hectic and ultimately died.

At the autopsy there were found—a suppurating cavity behind the bladder, with well-defined, rather thin walls, containing a few ounces of purulent fluid; great enlargement of the prostate, with a suppurating cavity communicating with the floor of the urethra; inflammation of the bladder, with several patches of diphtheritic-looking exudation on its mucous surface; catarrhal nephritis.

The above instance of this rare affection is the second¹ which Mr. Spence has met with in his practice. The fatal result must, unfortunately, be attributed to the false passage in the prostate and distension of the bladder giving rise to general inflammation of the urinary organs, and apparently to suppuration of the cyst: for it is probable that, had the urinary organs been in a quiescent state, simple puncture of the cyst would not have induced suppuration; and, had it done so, the chances of a favourable result would, notwithstanding, have been infinitely greater than they otherwise were.

CASE OF HYDATID CYST BETWEEN THE BLADDER AND RECTUM.

(From Clinical Report, 1862-3.)

J. F., æt. 55, a native of Yorkshire, was admitted August 23, suffering from retention of urine, to fits of which he had been liable for the previous eight months. On this occasion several unsuccessful attempts had been made to relieve him before sending him to Mr. Spence, who, on examination per rectum, detected a large fluctuating cyst in the recto-vesical space, and as the curvature of the urethra was thus increased, he selected a prostatic catheter and introduced it without much difficulty. A large quantity of water was drawn off, but the cyst, which at first was thought to be a dilated portion of the bladder, underwent no diminution in size. This proved its independent origin, and as the man was in apparently good health, and had never suffered from inflammatory symptoms in the pelvis, and as there was an indistinct feeling of a tumour deep in the right hypochondrium, it was thought probable that this was an instance of a hydatid cyst in a very uncommon situation. The patient was kept under observation, and the water regularly drawn off. At the end of a fortnight the cyst was tapped by a curved trocar introduced per rectum. A considerable quantity of clear fluid escaped, in which, both

¹ This is a mistake. The other case was that of hydatid cyst, which follows.

on ordinary visual, and on microscopic examination, numerous hydatids were detected. The discharge from the rectum continued for a few days and then ceased. The cyst refilled, but while the patient was making efforts at stool it burst; the fluid was again submitted to the microscope, and was found to contain the shreds of broken-down acephalocysts. For a short time discharge continued to be passed of a purulent character, but this gradually diminished, and ultimately disappeared, leaving only a degree of hardness in the position formerly occupied by the cyst. At the date of dismissal (10th October), the deep-seated swelling in the hypochondrium had become much more perceptible to the touch. It could then be defined as a small tumour, about the size of an orange. On his returning about a month afterwards it had attained the size of a melon; and on his again presenting himself, at the end of two months, it filled nearly the whole of one-half of the abdomen.¹

The case of hydatids is interesting from the rarity of this affection in Scotland; from the symptoms leading to a correct diagnosis of its nature; and from the effective treatment without any tendency of the inflammation of the cyst to spread to adjoining organs.

REMARKS ON THE SOURCES OF HÆMORRHAGE AFTER LITHOTOMY.

Reprinted from the *Edinburgh Monthly Medical Journal*, March 1841.

'L'hæmorrhagie est un des accidens les plus ordinaires de la lithotomie. Cet accident a souvent été mis sur le compte de l'opérateur, ou celui du procédé dont il a fait choix. Mais presque toujours injustement, parceque les artères du périnée offrent dans leur situation et dans leur direction, des variétés telles, que le chirurgien le plus habile n'est jamais absolument certain de les éviter, quelque soit le procédé dont il se serve.'—*Traité des Maladies Chirurgicales*, par M. le Baron Boyer; tome ix. p. 429. Paris, 1824.

As lithotomy has ever been, and in all probability will continue to be, a subject of deep interest to surgeons, I venture to hope that the following brief remarks, founded on numerous dissections of, and experiments on the parts concerned in lithotomy, combined with references to the experience of others, may prove in some degree acceptable to the profession, as they illustrate the sources of one of those dangers which attend the operation, and which render it desirable that the surgeon who undertakes its performance should be prepared against any accident which may occur.

It is not my intention at present to consider the respective risks of hæmorrhage in the different methods of performing lithotomy which from time to time have been proposed; but merely to confine myself to the consideration of the chances and causes of its occurrence in the lateral operation, which, in this country at least, has for a long series of years been almost unanimously declared the preferable method, and which, I believe, is the one now constantly practised, except in special cases. Since surgical anatomy—thanks to the works of our eminent countryman, the late Mr. John Bell—has been more carefully studied, the lateral operation of lithotomy, once so formidable, has

¹ I learned some years ago that this ultimately burst into the bowel, and the patient, when I heard of him last, was quite well.

been greatly simplified, and rendered comparatively safe. Still every one conversant with the subject knows that it is even yet far from being free from troublesome and dangerous accidents. And of these accidents, hæmorrhage, though now a much less frequent occurrence than in former times, is still of sufficient importance to demand all the care and attention of surgeons, and to afford an interesting field of investigation to the surgical anatomist. Although it may seem somewhat paradoxical, I think an additional reason for bringing this subject under the notice of the profession, is furnished by the fact that hæmorrhage is at the present day an accident of comparatively rare occurrence. For, emboldened by their own good fortune, some surgeons have gone so far as to countenance the opinion that whenever it does occur it must be the fault of the operator. Thus there is a stigma attached to cases of lithotomy attended by unusual hæmorrhage; and this, I fear, occasions a want of candour on the part of surgeons, for such cases are but seldom mentioned. The profession is thus deprived of much valuable information both as regards the details of particular cases, and also as to the general statistics of the frequency of this occurrence. Whilst from the slight manner in which most systematic works on surgery treat of the subject, the student, instead of being prepared for such a complication, is permitted to enter upon practice under the erroneous belief that if he follows accurately a certain line of incision in performing lithotomy, he will never meet with troublesome hæmorrhage. The following quotation, from one of the best modern works on surgery, will show that the statement I have just made is by no means too strong:—"If the incisions are placed low, as recommended, and the knife used cautiously in the deep incisions, there will be no trouble from bleeding. The artery of the bulb, which is often cut through *want of care*, and furnishes blood very freely, will, I believe, be quite safe in this mode of proceeding, *whether it follows the usual course or not*; as will the pudic itself, *whether it lies protected by the ramus of the ischium or comes from the internal iliac direct, and without passing behind the lesser sciatic ligament.*" Such statements are all the more dangerous when they come to us, as they do in the present instance, recommended by the authority of one of the most dexterous and successful lithotomists of the present age. And with all the deference I have for the opinions of Mr. Liston, I cannot help saying that I consider such expressions hasty and unguarded, and as resulting rather from his own successful practice, than as a doctrine which, on reflection, he would wish to impress in all its force on the minds of his readers. This opinion may appear presumptuous on my part, as opposed to his great practical experience; and it is one which I should not have ventured upon had I not known that profuse hæmorrhage had occurred in operations performed by the most able surgeons. For the recorded experience of some of the most successful lithotomists, both of our own and former times, still further strengthens my position; and as the limits of the present paper will not allow of quotations, I refer my readers to the works of Chesselden, Sir Charles Bell, Sir Benjamin Brodie, Mr. Benjamin Bell, Baron Dupuytren, Mr. Syme, Mr. Crosse, and to an excellent paper by Mr. Aston Key, for confirmation of this statement. But by far the most unequivocal proof is to be derived from anatomical investigations; for however lightly "the surgery of the dissecting-room" may be held by some, I doubt not the majority of the profession will admit that it is the best foundation of operative surgery at least, and that it affords the only sure means of deciding in cases like the one under consideration, where there exists so great a difference in the experience of surgeons. For, whilst all that the most experienced and successful lithotomist can say amounts merely to this, that in a certain number of cases on which he has operated he has never met with troublesome bleeding; anatomy,

on the other hand, furnishes positive proof. For if it can be demonstrated that large bloodvessels do occasionally run in such a manner as to cross the line of incision recommended, then it is evident, had the person in whom such an anomaly existed become the subject of lithotomy, hæmorrhage must inevitably have ensued. And what guarantee has any surgeon that he may not meet with similar cases?

It is my intention in this paper to state the results of a series of anatomical investigations which I have made in this subject. These were originally undertaken to satisfy myself regarding some disputed points in the operation of lithotomy; they consisted of numerous careful dissections of the parts concerned in the lateral operation, varied so as to exhibit them in all their different relations, and in performing the operation on the subject, and subsequently examining the exact relative position of the incision to the bloodvessels and other important parts. I may state that the number of male subjects I have thus examined during the last three years amounts to seventy-three. Having frequently noticed during these dissections the risk of hæmorrhage occurring from sources seldom mentioned in modern systematic works, I venture to publish the present remarks, as I believe I am in possession of sufficient data to prove that large bloodvessels do occasionally occupy such a position that it would be impossible to avoid them in performing lithotomy.

As the internal pudic artery, when wounded, is by far the most dangerous source of hæmorrhage, I shall begin by considering the relative anatomy of that vessel, when it occupies its usual situation, with reference to the incisions in lithotomy; next, the risk of hæmorrhage from the irregular distribution of the pudic artery, occasionally noticed; and then proceed to discuss the other sources of hæmorrhage.

INTERNAL PUDIC ARTERY.

The internal pudic artery having re-entered the pelvis between the great and lesser sciatic ligaments, attaches itself to the tuber and ramus ischii, and passes obliquely forwards towards the pubis, along the outer boundary of the perineum. It is this perineal portion of its course which we are at present to examine. The relations of the vessel in the posterior part of the perineum may be concisely stated as follows:—Externally it is in contact with the fibres of the obturator internus, which arise from the pelvic surface of the tuber ischii, to which it is closely bound down by a layer of the pelvic fascia, which descends upon its internal surface to join the falciform process of the great sciatic ligament, by which falciform process the artery is bounded inferiorly.

If the fat and cellular tissue be removed from the ischio-rectal space, the pudic artery, if well injected, will be felt through the layer of fascia which separates it from that space, lying about an inch above the internal margin of the tuberosity, but gradually approaching nearer the margin of the bone as it approaches the ramus of the ischium. When we consider the position of the artery as above described, and its relations to the lateral incision, which ought to be about midway between the anus and tuber ischii, or at most two-thirds from the anus and one from the tuberosity, it is evident that the vessel runs no risk in this part of its course, unless the surgeon deviate very far indeed from the line of incision; for to reach the artery the knife would require to be not only lateralised, but its edge actually turned towards the inner surface of the tuberosity and ramus of the ischium, which here project beyond and

protect the vessel. It must have been from viewing the artery in this posterior portion of the perineum which has led Messrs. Roux, Beclard, and Blandin, to deny the possibility of wounding the pudic trunk in lithotomy; for as the vessel passes forwards into the anterior part of the perineum it gradually leaves the protection of the ramus of the ischium, and where it gives off the artery of the bulb lies between the layers of the triangular ligament. This is the point where the pudic is in danger of being wounded by the gorget, the beaked knife, or lithotome caché, for in using these instruments the surgeon, after inserting the beak into the groove of the staff, depresses the handle of the staff, and, by a simultaneous movement of his right hand, thrusts the gorget or lithotome along the groove. The consequence is that the point of the staff being thus elevated, the cutting instrument is guided along it into the anterior and narrow portion of the perineum, the prostate is divided transversely, and the pudic artery is in great danger of being wounded on withdrawal of the instrument. Before, however, proceeding further to state my own opinions, deduced from the anatomy of the vessel, I shall give a brief summary of cases where this accident has occurred, and it will be seen that some of them happened in the hands of dexterous and experienced lithotomists.

The internal pudic was wounded by the celebrated Desault, who succeeded in tying it. Deschamps, however, seems to doubt that the wounded vessel was the pudic trunk. It was wounded in one case by the late Sir Charles Blicke, where Mr. Abernethy subsequently secured it by ligature. Sir Benjamin Brodie mentions having tied the pudic in a case operated on by the late Sir E. Home. Dr. Physick of New York wounded it in his first operation, on which occasion he used the cutting gorget; in this case the artery was also tied successfully. Mr. Lowe Wheeler mentions three cases in which he had seen this accident occur—one in Paris and two in London; in the first the lithotome caché was used to divide the prostate; in the other two Blizard's beaked knife. Mr. Crosse of Norwich, whose experience and dexterity in this operation are well known, also relates a fatal case of this nature in his own practice. A view of the parts obtained on dissection is given in the twenty-fifth plate of his admirable work. With such cases before us, we should be exceedingly cautious in pronouncing any opinion as to the accident being the fault of the operator. It is, however, worthy of remark that in all the cases mentioned, with the exception of that by Mr. Crosse, who does not give the particulars of the operation, the instruments used to divide the prostate were either the cutting gorget, Blizard's beaked knife, or the lithotome caché; the method of using which, and the danger arising from it, I have already explained. And after mature consideration of the surgical relations of the vessel, and of the cases in which it has actually been wounded, I cannot help thinking that if the operation be performed with the knife, the staff held steady by an assistant from first to last, and the prostate divided obliquely downwards and outwards, wound of the pudic artery will be a rare occurrence indeed.

Irregularities of Internal Pudic.—I scarcely know of any variety which can be properly termed irregular distribution of the pudic trunk. The nearest approach to such a variety, of which I am aware, is preserved in the Anatomical Museum of the University, and is described by Dr. Monro, in his excellent work on the Pelvis. The irregularity is on the right side. The irregular vessel comes off from the internal iliac direct, passes along the lateral and inferior surface of the bladder, pierces the ileo-vesical fascia, runs along the lateral lobe of the prostate, and divides into three branches, one to the dorsum penis, and one to the crus, whilst the third runs along the membranous part of

the urethra to gain the bulb. Another preparation somewhat similar is contained in the collection of Dr. Allen Thomson, Professor of Anatomy at Aberdeen, who kindly favoured me with a full description of it, from which the following is an extract :—"It is situated at first between the bladder and rectum, farther down it appears to be on the side of the prostate, crossing it and the membranous portion of the urethra obliquely, before arriving at the subpubic arch, and *quite below the anterior true ligament of the bladder*; when it reaches the subpubic arch the artery gives downwards a considerable branch, which soon dividing into two, sends one twig into each crus penis. The artery is then continued along the dorsum of the penis as far as the glans." In a subject which I dissected lately I found a large vessel arising from the internal iliac in common with the obturator; it then passed along the side of the bladder, and over the upper surface of the prostate; on arriving near the pubic arch it pierced the fascia immediately external to the left anterior true ligament of the bladder, and divided into three branches; one entered the spongy part of the urethra about an inch anterior to the bulb; the other two branches were distributed, one to the dorsum, the other to the crus penis. If such an anomaly as that described in either of the two first mentioned cases existed on the left side of a person who was to undergo the lateral operation, the artery must inevitably be wounded either in opening the urethra or on dividing the prostate. In the case which I myself dissected, the vessel would have been in no danger, for it lay completely above the line of incision, and on the upper surface of the prostate.

The variety described by Haller, Burns, Tiedemann, Harrison, and others, which is frequently but erroneously termed irregularity of the pudic trunk, is merely a variety of its terminal branch, the dorsalis penis, and is comparatively common. In my own dissections I have met with five cases, and I saw another during last autumn in a subject dissected by my friend Dr. Duncan. In all these cases the course of the irregular vessel was precisely similar: it passed along the lower and lateral part of the bladder, then coursed obliquely across its neck, *above the reflection of the ileo-vesical fascia*, over the upper surface of the prostate gland, and passed out of the pelvis between the anterior true ligaments of the bladder. From a consideration of the relative anatomy of this variety, I think it runs no risk of being wounded if the operation be performed according to the method now generally recommended, viz. dividing the prostate obliquely downwards and outwards, leaving the neck of the bladder and the reflection of the ileo-vesical fascia entire, because the vessel runs above the reflection of that fascia; at least it has done so in every case which I have seen. The same fact was particularly noticed by the late Mr. Allan Burns, and in Tiedemann's plate of this variety the vessel is shown in the same relative position to the prostate. Mr. Harrison, however, in his work on the Arteries, describes the vessel as passing along the *side* of the prostate, and states his opinion that it is in great danger of being wounded in lithotomy. I am, however, inclined to think the vessel, in the cases seen by Mr. Harrison, took the usual course, more particularly as he never mentions it as piercing the fascia, without doing which it could not possibly reach the *side* of the prostate; and, moreover, he describes it passing out between the anterior true ligaments, which leads to the supposition that it must have passed along the upper surface of the gland. Perhaps Mr. Harrison's opinion as to the risk of wounding the vessel may depend on his particular views as to the requisite extent of the incision, for if it be carried beyond the reflexion of the fascia, and through the neck of the bladder, then, unquestionably, wound of this variety is inevitable, and has actually occurred in one unfortunate case. In the case alluded to, the operation was performed by the late

Mr. Shaw, an eminent anatomist and surgeon. But it will be seen, by referring to that gentleman's remarks on the methods of performing lithotomy, that he was of opinion that the whole extent of the left lobe of the prostate, and the fascia enveloping it, together with the neck of the bladder, should be freely divided, to allow of the easy extraction of the stone. In performing the operation on these principles, he was so unfortunate as to meet with the variety which we have been considering, and the wound of which gave rise to fatal hæmorrhage. It is true that some authors, particularly MM. Velpeau and Lizars, describe the vessel in Mr. Shaw's case as passing along the side of the prostate and urethra. But any one who consults Mr. Shaw's own narrative of the case, and examines the plate which accompanies it, will at once perceive that the vessel was the ordinary variety of the dorsalis penis, and that its wound was owing to the extent of the incision.

The branches of the internal pudic which may give rise to hæmorrhage, come next to be considered; and of these, the first branch given off in the perineum is

The Inferior Hæmorrhoidal.—This vessel leaves the pudic opposite the tuber ischii, and is of a considerable size at its origin; but shortly after piercing the fascia which binds down the pudic, it divides into several branches, which pass across the ischio-rectal space, and again subdivide as they approach the levator ani; some pass into and through that muscle to the lower part of the bowel—others are distributed about the anus. In a few cases I have seen the vessel pass almost across the ischio-rectal space without dividing into branches; and as it must always be cut in lithotomy, I should think that in such a case it would bleed profusely, both on account of its own size and its proximity to the pudic trunk. I believe, however, that in most cases the artery could be readily enough secured, unless it be cut so close to its origin as to retract within the fascia, or its coats so diseased as not to hold a ligature, a state in which I have frequently found the hæmorrhoidals in old people; and Mr. Liston mentions a remarkable case of fatal hæmorrhage from this diseased state of the arteries.

Superficial Perineal Artery.—This vessel arises a little anterior to the hæmorrhoidal, pierces the fascia, and winds round the transversus perinei muscle, along which it sends a small branch (transversalis perinei), and continues its course towards the scrotum, covered by the superficial perineal fascia, and lying along the internal edge of the erector penis. This vessel is in considerable danger in performing lithotomy, as it frequently lies exactly along the line of incision. Indeed, I believe it is very frequently cut, but generally soon ceases to bleed; or if it does not, it can be readily enough secured, as it lies very superficial. M. Roux has remarked, however, that if the surgeon, by lateralising the knife too much, divide the artery near to its origin, it may retract within the opening of the fascia through which it passed, and by bleeding profusely simulate wound of the pudic trunk. M. Roux, indeed, is of opinion that this is what has happened in all the cases in which the pudic is said to have been wounded from lateralising too much. Although I do not go so far as M. Roux, I yet believe that his opinion is correct to a certain extent; for when we consider that the artery is stretched during the operation by the scrotum being drawn upwards, we will perceive how apt it will be to retract within the fascia, if divided close to its origin.

Artery of the Bulb (L'artère transverse du périnée).—This artery, generally of considerable size, when it follows its usual course arises from the pudic about 14 lines in front of the anus, and passes across the perineum towards the bulb, lying between the layers of the triangular ligament, and gives off a small twig to Cowper's gland before entering the bulb. Mr. Liston is of

opinion that this vessel is in no danger in lithotomy if the incisions be properly made ; but states that it is often cut from want of care ; whilst Mr. Key states that although, in experimenting on the subject, he has in general been able to avoid it by cutting very low, he nevertheless believes the vessel must almost always be divided when operating on the living. Sir Charles Bell, after observing that this vessel is often needlessly cut, says, " Yet it is not easy assuredly to avoid it." Mr. Crosse thinks the artery of the bulb is frequently cut, and sometimes on both sides. He mentions a case in which the artery on the right side was divided whilst the left was intact. M. Blandin admits that this vessel in many cases cannot be avoided. To satisfy myself more fully than I could by ordinary dissection, as to the risk of wounding the artery of the bulb, I performed the lateral operation six times during the session of 1839-40, on subjects previously well injected. In three of these the operation was performed with the curved staff and Mr. Liston's knife ; in two with the straight staff ; and in one with Scarpa's cutting gorget. In none of these experiments was the vessel actually cut ; but in no case was there more than a few lines of substance between the anterior part of the deep incision and the vessel ; whilst in one of the cases where the operation was performed with the curved staff, the artery had been just pushed up before the back of the knife, its lower surface being quite bare. From the proximity of the artery to the incision in these and many previous experiments, and from having observed in my dissections of the perineum that the artery of the bulb frequently lies little more than an inch in front of the anus, I am inclined to think that the vessel must be frequently divided in operating on the living. For we cannot well begin our incision lower in the perineum than 14 lines in front of the anus, otherwise we are in danger of cutting into the groove of the staff through the substance of the prostate, leaving the membranous part of the urethra and the apex of the gland undivided, a circumstance which would cause great difficulty in the extraction of the stone. It may be asked, Why, then, is hæmorrhage so rare ? I reply, because in most cases the vessel is divided near the bulb, at a distance from its origin. Again, in some cases the artery is small, and I have several times seen its place supplied by three or four twigs from the pudic. The frequency of wound of the bulb itself (in which case this vessel must be wounded), together with an instance related by Sir Astley Cooper, in which he arrested bleeding from the urethra by cutting down upon and dividing this artery, are further proofs that it may in some cases be cut without giving rise to profuse hæmorrhage. Indeed, I suspect the greatest risk of bleeding is where the vessel is only wounded without being fairly cut across.

Irregularities.—In a subject which I dissected in 1837 the artery of the bulb arose from the pudic as usual, but then passed almost directly backwards to near the anus, whence it again curved upwards to gain the bulb. I have also seen two cases similar to that described by Mr. Stanley, in which the vessel came off from the pudic posterior to its usual origin, ran immediately above the inferior margin of the triangular ligament, and then passed upwards to the bulb. It is evident that in such cases, and also where the vessel comes off from the irregular pudic trunk and runs along the membranous part of the urethra, as in the case mentioned by Dr. Monro, of which I have already spoken, this artery must be divided in the lateral operation ; and the existence of these anomalies sufficiently disprove Mr. Liston's sweeping assertion that the artery of the bulb runs no risk, whatever be its course, if the incisions be made low in the perineum.¹

¹ Many years after the publication of this paper, I met with a remarkable irre-

The vessels I have been describing hitherto are those generally regarded as the sources of hæmorrhage in lithotomy. I come now to consider a class of vessels which, although they were occasionally noticed as sources of hæmorrhage by the older surgical writers, have never, as far as I can find, been deemed of sufficient importance to engage the attention of modern anatomists. The *prostatic artery* arises sometimes as a distinct branch from the internal iliac, but more generally in common with the vesical, or from the internal pudic, in the first part of its course before it leaves the pelvis. In the great majority of cases the vessel passes along the lateral and inferior surface of the bladder towards its neck, then pierces the ileo-vesical fascia and gains the side of the prostate, on which it divides into numerous twigs, which supply that gland and the neighbouring surface of the rectum. In such a distribution of the artery it is not likely to furnish much blood if divided; but in several instances I have seen the prostatic artery gain the perineal surface of the prostate without dividing into minute branches; and in eight of these cases the vessel was fully as large as the artery of the bulb, and would have bled profusely if divided, as it must inevitably have been in the lateral operation of lithotomy. To obtain a view of the relative anatomy of this artery, with reference to the incision of the prostate, the superficial muscles of the perineum, the anterior layer of the triangular ligament, and the levatores ani require to be removed. The posterior layer of the triangular ligament, immediately above which the vessel lies, is then to be carefully dissected off, when the artery or its branches will be seen lying on the perineal surface of the prostate gland. I have said that the vessel was noticed by the older surgical authors. Douglas thus speaks of it, when describing the parts cut in Cheselden's operation—"When the prostate gland is divided near the rectum or back part of the pelvis, a large straight arterial branch can seldom escape the knife." Sharpe speaks of applying styptics to "the artery creeping upon the prostate." And more recently, Mr. Carpuë speaks of "a branch of the internal pudical artery ramifying on the prostate," and states that he has known "several patients die in consequence of the division of this artery." This statement of Mr. Carpuë was severely criticised by a gentleman who denied the existence of any such vessels, and who accused Mr. C. of mistaking the prostatic veins for arteries. Lest I should fall under a similar accusation I would request my critical friends to suspend their judgment until they have examined the sketches

gularity of the artery of the bulb in a young subject. It must be exceedingly rare, as it is the only instance of the kind I have ever seen in all my dissections of the male perineum. I do not know of any instance of similar irregularity recorded. The dissection is still in my possession, preserved in spirits, so as to retain the exact relation of parts. In this case the internal pudic artery arises as usual and takes its normal course, but after giving off the superficial perineal it terminates by dividing into the artery to the crus penis and the dorsalis penis, it gives off no twig even to the bulb. The artery of the bulb arises from the anterior or internal division of the internal iliac artery, passes along the side of the bladder, and upon the upper surface of the prostate pierces the fascia forming the left true ligament of the bladder, and then bends directly backwards from the pubic arch so as to cross obliquely the course of the membranous portion of the urethra, and then turns slightly forwards to enter the bulb. This is by far the most dangerous variety I have met with, but even in such a case, if the surgeon feels for, and enters his knife into the groove of the staff from below, as directed in my description of lateral lithotomy, I believe that the irregular vessel might escape injury.

which accompany this paper,¹ which I trust will convince the most sceptical that large arteries do sometimes run on the prostate, and that the appearance of the prostatic veins is somewhat different. I am strongly inclined to believe that in many of the cases where the blood is described as flowing from near the neck of the bladder, as in the case of the boy mentioned by Cheselden, that the prostatic artery has been the vessel injured; and from what I have seen in my own dissections I regard it as a very dangerous source of hæmorrhage.

Having now described those vessels which, in my opinion, are the principal sources of arterial hæmorrhage in lithotomy, I come next to determine, from the anatomy of the parts, what is the risk of venous hæmorrhage in the operation. It is only of late years that surgical writers have directed their attention to this subject, and even yet they do not seem fully to appreciate the danger of bleeding from the large veins which are sometimes wounded in lithotomy. For even Sir B. Brodie, in his admirable work on *Diseases of the Urinary Organs*, in mentioning a fatal case of hæmorrhage from near the prostate, says, "and what was remarkable, it was venous," an expression which would lead us to suppose that his attention had then, for the first time, been drawn to this kind of bleeding. Mr. Liston and Mr. Lizars, although they both notice the danger of bleeding from the prostatic plexus of veins, if wounded, seem to think that it should properly not be interfered with. I think this opinion must have reference only to the superior prostatic veins, which, commencing in the dorsal veins of the penis, form a network on the upper surface of the ileo-vesical fascia, and on the upper surface of the prostate. But if the plexus be moderately injected from the dorsal veins, and the perineum dissected in the manner recommended when describing the prostatic arteries, it will be found that a plexus of veins (or in old men rather venous sinuses), which may be termed the inferior plexus, covers the lower or perineal surface of the prostate. And it is evident that this plexus, from its position (which is well shown in the accompanying sketch, fig. 2),² must inevitably be wounded, in making even the most limited incision of the prostate gland. When we consider, moreover, that it communicates freely with the superior prostatic plexus, and inferiorly with the middle hæmorrhoidal veins, and remember the want of valves in these vessels, and their dilated form in old persons, I think it must be allowed that, in them at least, this plexus constitutes a formidable source of hæmorrhage after lithotomy. And of late years it has been noticed as such by Baron Dupuytren, Dr. Monro, MM. Volpeau and Robert, the last of whom has recorded two cases of hæmorrhage from this source.

I have now described all the vessels which I think likely to be sources of serious hæmorrhage in the lateral operation of lithotomy. I would however observe, before concluding, that the vessels which I consider the most likely to give rise to such an accident are the artery of the bulb, and the artery of the prostate when large. For I have found, during my investigations, three cases of irregularity in the artery of the bulb, and eight of the enlarged prostatic artery; so that, in eleven cases out of the seventy-three subjects dissected by me, these vessels must inevitably have been wounded, owing to their position. I also think that these facts are sufficient to prove that hæmorrhage may sometimes occur without any fault on the part of the operator.

¹ This refers to the lithographs accompanying the original paper, which I cannot now reproduce.

² See former footnote.

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